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FIFTY-EIGHT ANNUAL REPORT

TO THE International Joint Commission

COVERING Calendar Year 2016

International Souris River Board

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INTERNATIONAL SOURIS
RIVER BOARD

CONSEIL INTERNATIONALE
DE LA RIVIERE SOURIS

October 2017

The International Joint Commission
Ottawa, Ontario and Washington, D.C.

Commissioners:

In accordance with the Directive of January 22, 2007 (replaces Directives of April 11, 2002 and May 31, 1959), we have enclosed the Fifty-Eight Annual Report covering calendar year 2016.

Respectively submitted,

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TABLE OF CONTENTS

HIGHLIGHTS 2016

LIST OF TABLES

PAGE

LIST OF FIGURES

APPENDICES

HIGHLIGHTS 2016

For the 2016 calendar year, the natural flow of the Souris River at the Sherwood Crossing was 47 925 cubic decametres (38,869 acre-feet), which represents 30 percent of the 1959-2016 long-term mean. North Dakota received 43 119 cubic decametres (34,970 acre-feet) or 90 percent of the natural flow.

Net depletions in Canada were 4 806 cubic decametres (3,898 acre-feet). Recorded runoff for the Souris River near Sherwood, North Dakota, was 41 291 cubic decametres (33,488 acre-feet), or about 30 percent of the 1931-2016 long-term mean.

The apportionment between Canada and the United States was discussed at the February 24, 2016 meeting of the International Souris River Board. The Board reviewed the spring 2016 runoff forecast hydrologic conditions and declared 2016 to be a non-flood year.

The natural flow at Sherwood did not exceed 50 000 cubic decametres (40,535 acre-feet), resulting in a 50/50 sharing of the natural flow at the Sherwood Crossing.

The flow of the Souris River as it enters North Dakota at Sherwood was more than 0.113 cubic metres per second (4 cubic feet per second) for the entire year. Accordingly, Saskatchewan complied with the 0.113 cubic metres per second (4 cubic feet per second) provision specified in Recommendation No. 1 of the Interim Measures.

Recorded runoff for Long Creek at the Western Crossing as it enters North Dakota was 1 037 cubic decametres (841 acre-feet), or 3.3 percent of the long-term mean since 1959. Recommendation No. 2 of the Interim Measures was met with a net gain in the North Dakota portion of the Long Creek basin of 5 288 cubic decametres (4,289 acre-feet).

Recorded runoff leaving the United States at Westhope during the period of June 1 through October 31, 2016, was 47 179 cubic decametres (34,245 acre-feet). The flow was not in compliance with the 0.566 cubic metres per second (20 cubic feet per second) minimum flow requirement for the June 01 to October 31 period as specified in Recommendation No. 3(a) of the Interim Measures. The period of noncompliance was October 18, 19, 20 and 23rd. The noncompliance was due to extreme wind fetch combined with minimal flows.

The water quality of the Souris River in calendar year 2016 has had median values approximately the same or less than the median values over the past four years for most of the parameters. When compared to the historical median, most of the median values in 2016 are similar.

Low dissolved oxygen levels, of great concern in the past, were at or above the water quality objective of 5.0 milligrams per litre at both boundary stations, except for a single low value at Westhope in January.

The exceedances that occurred at both sites were for parameters that historically have had exceedances of the water quality objectives. Exceedances of specific water quality objectives at the Saskatchewan/North Dakota boundary include phosphorus, sodium, sulfate, total dissolved solids and iron. Exceedances of specific water quality objectives at the Manitoba/North Dakota boundary include phosphorus, sodium, sulphate, total dissolved solids, iron, pH, and fecal coliform. Picloram also exceeded the objective three times at Westhope.

In 2016, the International Joint Commission appointed Debbie McMechan to the International Souris River Board.

Todd Sando retired from is position of State Engineer of North Dakota and the U.S. Chair to the Board in June 2016.

In 2016, the International Joint Commission appointed Garland Erbele as the U.S. Chair to the International Souris River Board.

1.0 INTERNATIONAL SOURIS RIVER BOARD

1.1 SOURIS RIVER REFERENCE (1940)

The following excerpt describes the history of the water-apportionment program that the International Souris River Board currently maintains.

In a letter on behalf of the Government of Canada dated 20 March 1959 and a letter on behalf of the Government of the United States of America dated 3 April 1959, the International Joint Commission was informed that the Interim Measures recommended in its report of 19 March 1958, in substitution for those recommended in the report dated 2 October 1940 in response to the Souris River Reference (1940), had been accepted by both Governments.

The Governments of the United States and Canada entered into an Agreement for Water Supply and Flood Control in the Souris River Basin on October 26, 1989. Pursuant to this Agreement, the Interim Measures related to the sharing of the annual flow of the Souris River from Saskatchewan into North Dakota contained in paragraph 22(1) of the Commission's 1958 Report to the Governments were modified. In light of the modifications in 1989 and pursuant to a February 28, 1992, request from the Governments of the United States and Canada, the Commission, on April 23, 1992, directed the International Souris River Board of Control to begin applying the "Interim Measures as Modified in 1992." The measures were further modified by the Governments in December 2000. The "Interim Measures as Modified in 2000" are shown in Appendix C of this report.

1.2 INTERIM MEASURES AS MODIFIED IN 2000

In December 2000, the International Joint Commission directed the Board to implement the "Interim Measures as Modified in 2000" for the 2001 calendar year and each year thereafter. The 2000 Interim Measures, shown in Appendix C, were developed to provide greater clarification of the conditions that must prevail for the determination of the sharing of natural flow between Saskatchewan and North Dakota at the Sherwood Crossing.

In general, the Interim Measures provide that Saskatchewan shall have the right to divert, store, and use waters that originate in the Saskatchewan portion of the Souris River basin, provided that the annual runoff of the river into North Dakota is not thereby reduced to less than half of the runoff that would have occurred in a state of nature; that North Dakota shall have the right to divert, store, and use the waters that originate in the North Dakota portion of the basin together with the waters that cross the boundary from Saskatchewan; and that Manitoba shall have the right to use the waters that originate in the Manitoba portion of the basin and, in addition, that North Dakota must provide to Manitoba, except during periods of severe drought, a regulated flow of at least 0.566 cubic metres per second (20 cubic feet per second) during the months of June through October.

For the benefit of riparian users of water between the Sherwood Crossing and the upstream end of Lake Darling, the Province of Saskatchewan shall as far as practicable regulate its diversions, storage, and uses in such a manner that the flow in the Souris River channel at the Sherwood Crossing shall not be less than 0.113 cubic metres per second (4 cubic feet per second) when that level of flow would have occurred under the conditions of water-use development prevailing in the Saskatchewan portion of the drainage basin prior to the construction of Boundary Dam, Rafferty Dam, and Alameda Dam.

Under certain conditions, a portion of the North Dakota share will be in the form of evaporation from Rafferty and Alameda Reservoirs. During years when those conditions occur, the minimum flow actually passed to North Dakota will be 40 percent of the natural flow at the Sherwood Crossing. This lesser amount is in recognition of Saskatchewan's operation of Rafferty Dam and Alameda Dam for flood control.

Except in flood years, flow releases to the United States should occur in the pattern that would have occurred in a state of nature. To the extent possible and in consideration of potential channel losses and operating efficiencies, releases from the Canadian dams will be scheduled to coincide with periods of beneficial use in North Dakota. The flow release to the United States may be delayed when the State of North Dakota determines and notifies Saskatchewan through the International Souris River Board that the release would not be of benefit to the State at that time.

The State of North Dakota shall have the right to divert, store, and use the waters that originate in the North Dakota portion of the Souris River basin together with the waters delivered to the State of North Dakota at the Sherwood Crossing, provided that any diversion, use, or storage of Long Creek water shall not diminish the annual runoff at the Eastern Crossing of Long Creek into Saskatchewan below the annual runoff of Long Creek at the Western Crossing into North Dakota.

In periods of severe drought, when it becomes impracticable for North Dakota to deliver the regulated flow of 0.566 cubic metres per second (20 cubic feet per second), North Dakota's responsibility to Manitoba will be limited to providing such flows as the Board determines to be practicable and in accordance with the objective of making water available for human and livestock consumption as well as for household use.

1.3 BOARD OF CONTROL

In May 1959, the International Joint Commission officially approved and signed a directive that created the International Souris River Board of Control. The directive charged the Board with the responsibility of ensuring compliance with the Interim Measures as set out in 1958 and of submitting such reports as the Commission may require or as the Board at its discretion may desire to file.

1.4 AMALGAMATION OF THE INTERNATIONAL SOURIS-RED RIVERS ENGINEERING BOARD AND INTERNATIONAL SOURIS RIVER BOARD OF CONTROL

In 2000, the International Joint Commission directed the International Souris-Red Rivers Engineering Board to transfer its responsibilities that related to the Souris River to the International Souris River Board of Control. The Commission also changed the International Souris River Board of Control's name to the International Souris River Board.

1.5 AMALGAMATION OF THE INTERNATIONAL SOURIS RIVER BOARD AND SOURIS RIVER BI-LATERAL WATER QUALITY MONITORING GROUP

By letter dated January 22, 2007, the International Souris River Board was officially notified by the Commission that the new directive dated January 18, 2007, replaced the previous directive dated April 11, 2002. The new directive sets out the duties of the Board as it moves toward a watershed approach in the Souris River basin and combined the duties of the International Souris River Board and Souris River Bi-Lateral Water Quality Monitoring Group. It also increased the membership of the Board to twelve members.

The Board's duties were revised to include the following:

- Maintain an awareness of existing and proposed developments, activities, conditions, and issues in the Souris River basin that may have an impact on transboundary water levels, flows, water quality, and aquatic ecosystem health and inform the Commission about existing or potential transboundary issues.

- Oversee the implementation of compliance with the Interim Measures as Modified for Apportionment of the Souris River as described in Appendix A of the Directive.

- Assist the Commission in the review of a Joint Water Quality Monitoring Program.

- Perform an oversight function for flood operations in cooperation with the designated entities identified in the 1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River Basin.

- Report on aquatic ecosystem health issues in the watershed and regularly inform the Commission on the state and implications of aquatic ecosystem health.

- Carry out such other studies or activities as the Commission may, from time to time, request.

- Prepare an annual work plan including both routine board activities and new initiatives planned to be conducted in the subsequent year.

- The Board shall submit an annual report covering all of its activities at least three weeks in advance of the Commission's fall semi-annual meeting, and the Board shall submit other reports as the Commission may request or the Board may feel appropriate in keeping with this Directive.

- The Board shall provide opportunities for the public to be involved in its work, including at least one public meeting in the basin each year. The Board has agreed to hold the public meeting in the spring/summer and to advertise it.

In 2007 three committees were established to assist the Board administer the requirements of its enhanced mandate. The Natural Flow Methods Committee was renamed as the Hydrology Committee and is charged with investigating procedures and questions on the approach and methods used to determine the natural flow of the Souris River basin. The Flow Forecasting Liaison Committee has the responsibility to ensure information sharing and coordination between the forecasting agencies in the basin. The Aquatic Ecosystem Health Committee has the responsibility to identify water quality and aquatic health concerns in the basin and to report on the adequacy of the aquatic quality monitoring programs. Membership on these committees includes all affected agencies in the basin.

1.6 BOARD MEMBERS

At the end of 2016, the members of the International Souris River Board were as follows:

Russell Boals Retired (Co-Chair) Regina, Saskatchewan	Member for Canada
John Fahlman Saskatchewan Water Security Agency Moose Jaw, Saskatchewan	Member for Canada
Nicole Armstrong Manitoba Sustainable Development Winnipeg, Manitoba	Member for Canada
Mark Lee Manitoba Sustainable Development Regina, Saskatchewan	Member for Canada
John-Mark Davies Saskatchewan Water Security Agency Saskatoon, Saskatchewan	Member for Canada
Jeff Woodward Environment and Climate Change Canada Winnipeg, Manitoba	Member for Canada
David Pattyson Agri-Environmental Group Plans Tribune, Saskatchewan	Member for Canada
Debbie McMechan Reeve of Two Borders Two Borders, Manitoba	Member for Canada
Joe Goodwill Deputy-Mayor of Souris Souris, Manitoba	Member for Canada
Garland Erbele North Dakota State Engineer Bismarck, North Dakota	Member for the United States (Co-Chair)
Colonel Daniel Koprowski U.S. Army Corps of Engineers St. Paul, Minnesota	Member for the United States
Gregg Wiche Retired Bismarck, North Dakota	Member for the United States

Scott Gangl North Dakota Game and Fish Department Bismarck, North Dakota	Member for the United States
Dave Glatt North Dakota Department of Health Bismarck, North Dakota	Member for the United States
Shelly Weppler Ward County Commissioner Minot, North Dakota	Member for the United States
Lorinda Haman North McHenry Soil Conservation District Towner, North Dakota	Member for the United States

2.0 2016 ACTIVITIES OF THE BOARD

Since the presentation of the Fifty - Seventh Annual Report to the International Joint Commission, the International Souris River Board has held two meetings. The discussions and decisions made are summarized in the following sections.

2.1 FEBRUARY 24, 2016, MEETING IN BISMARCK, NORTH DAKOTA

Members in attendance were:

Russell Boals
Member for Canada

John Fahlman
Member for Canada

Nicole Armstrong
Member for Canada

Mark Lee
Member for Canada

Jeff Woodward
Member for Canada

John-Mark Davies via conference call
Member for Canada

David Pattyson
Member for Canada

Joe Goodwill
Member for Canada

Todd Sando
Member for the United States

Megan Estep
Member for the United States

Gregg Wiche
Member for the United States

Dave Glatt
Member for the United States

Scott Gangl
Member for the United States

Lee Staab
Member for the United States

Shelly Weppler
Member for the United States

Lorinda Haman
Member for the United States

The Determination of Natural Flow of the Souris River at Sherwood for the period of January 1 through December 31, 2015, was presented at the February 24, 2016, meeting.

Environment and Climate Change Canada reported the 2015 natural flow for the period ending on December 31, 2015. The total diversion in the Souris River basin was 45 678 cubic decametres (37,046 acre-feet). Recorded flow at Sherwood was 224 781 cubic decametres (182,304 acre-feet). The natural flow computed at Sherwood was 213 377 cubic decametres (173,055 acre-feet). According to the computations, the United States 40 percent share was 85 510 cubic decametres (69,351 acre-feet). The flow received by the US was 226 895 cubic decametres (184,018 acre-feet), which constitutes a surplus delivery of 141 385 cubic decametres (114, 668 acre-feet). The annual flow requirement/apportionment at Long Creek was also met with a surplus of 4 227 cubic decametres (3,428 acre-feet).

As in previous years, the summary of natural flow computations showed that there were continuous high deliveries to the United States since 2009. The International Souris River Board accepted the Natural Flow Computation to December 31, 2015.

The United States Geological Survey reported the total volume of flow past the Long Creek at Noonan gage through December 31, 2015 calendar year was 30 155 cubic decametres (24,447 acre-feet). The volume is about 156 percent greater than the median flow for the last 56 years. The peak discharge for the reporting period January 1 to December 31, 2015 was 31.2 cubic metres per second (1,100 cubic feet per second), which ranks 22 in 56 years of record.

The total volume of flow past the Souris River near Sherwood gage through December 31, 2015 calendar year was 224 781 cubic decametres (182,230 acre-feet). This year's total flow is 342 percent greater than the median flow for the last 85 years. The United States Geological Survey also reported the peak discharge at Sherwood was 53 cubic metres per second (1,870 cubic feet per second) for the reporting period January 1 to December 31, 2015.

The total volume of flow at Westhope for 2015 was 414 514 cubic decametres (336,047 acre-feet). The flow at Westhope was in compliance with the 0.566 cubic metres per second (20 cubic feet per second) minimum flow requirement as specified in Recommendation No. 3(a) of the Interim Measures. The minimum flow for the period was 0.26 cubic metres per second (9 cubic feet per second), which occurred from February 15-18, 2015. The peak flow at Westhope was 60 cubic metres per second (2,120 cubic feet per second) on April 9, which ranks 29 in 86 years of record.

The United States Fish and Wildlife Service presented a summary of refuge operations and flows for 2015. The total provisional inflow measured at Sherwood for the first five months of the year was 178 791 cubic decametres (144,946 acre-feet). This was 172 percent of the historic January-May inflow, which was 103 975 cubic decametres (84, 293 acre-feet) for the period 1938 through 2015. The total Upper Souris Refuge pool volume increased an estimated 18 146 cubic decametres (14,711 acre-feet) during the first five months. The total provisional outflow measured at Foxholm on the south end of the Upper Souris Refuge for the first five months of 2015 was 172 295 cubic decametres (139,680 acre-feet). This outflow was 194 percent of the historic record for the January-May outflow, which was 88 589 cubic decametres (71,819 acre-feet) for the period 1938-2015. Lake Darling elevation increased 0.23 metres (0.74 feet) from 486.49 metres (1596.09 feet) on January 1 to 486.56 metres (1596.34 feet) on May 31, 2015. Lake Darling was at 486.77 metres (1597.01 feet) on June 1, 2015.

Total 2015 annual provisional flow at Sherwood was 224 763 cubic decametres (182,216 acre-feet). This was 153 percent of the historic average annual inflow (based on calendar year), which is 147 246 cubic decametres (119,348 acre-feet) for the period of record from 1938-2015. Total annual provisional outflow measured at the Souris River near Foxholm on the south end of the Refuge was 224 689 cubic decametres (182,156) acre-feet for the period 1938-2015. Total inflow was 74 cubic decametres (60 acre-feet) more than total measured outflow. On December 31, 2015, Lake Darling was at an elevation of 486.44 metres (1595.93 feet).

With regards to the J. Clark Salyer National Wildlife Refuge, the total provisional flow measured from the Souris River to the Refuge from January 1 through May 31 was 251 606 cubic decametres (203,977 acre-feet). This was 189 percent of the historic January –May inflow, which was 133 186 cubic decametres (107,974 acre-feet) for the period of 1938-2015. Pool volume on May 31 was 45 822 cubic decametres (37,148 acre-feet). This was 28 367 cubic decametres (22,997 acre-feet) above the January 1 volume. Approximately, 253 960 cubic decametres (205,886 acre-feet) was passed to Manitoba during the five-month period.

Total outflow measured at Westhope for 2015 was 414 514 cubic decametres (336,047 acre-feet). Total outflow was 48 701 cubic decametres (39,482 acre-feet) more than inflow on the Souris River at Bantry. Outflow during the June 1 to October 31 period was 124 231 cubic decametres (100,714 acre-

feet) or 116 745 cubic decametres (94,365 acre-feet) above the 7 486 cubic decametres (6,069 acre-feet) required minimum. The flow at the Westhope gage never fell below the minimum 0.57 cubic metres per second (20 cubic feet per second) threshold during this time period. The lowest recorded daily mean flow during the June 1 to October 31 time period was 1.78 cubic metres per second (63 cubic feet per second) and occurred on October 12, 2015.

Manitoba reported precipitation in 2015 was above normal for Manitoba. Spring melt started in early to mid-March, slightly earlier than usual. The Souris River at Wawanesa peaked at 128.8 cubic metres per second (4,550 cubic feet per second) on March 30th, which is considered to be a 1 in 4 flood event. Although Manitoba tributaries began rising in mid-March, they were interrupted by a cool period. Flows resumed when temperatures rose again close to the end of March. This resulted in two spring peaks, the first in mid-March and the second in early April. The peaks were similar in magnitude and had return periods in the range of 2-year to 5-year flood events. The Souris River at Wawanesa remained much above normal all summer, but returned to near the median flow.

The Saskatchewan Water Security Agency reported that fall 2015 precipitation in the Saskatchewan portion of the Souris Basin was close to average. Snowfall was below average for the winter. There were several periods of melt and occasional rain in January of 2016 that have complicated the situation. As a result, no snow surveys were done in the Canadian portion of the basin because there was no snow. The estimated precipitation was 20 to 30 mm, which is 40-60 percent of normal. Boundary Reservoir was at an elevation of 560.18 metres (1,837.8 feet) on February 15, 2016, slightly above its required February 1, 2015 pre-runoff drawdown elevation target of 560.0 metres (1,837.4 feet).

Rafferty Reservoir was at an elevation of 549.5 metres (1,802.8 feet) on February 15, 2016. The required February 1, 2016, drawdown for elevation as specified by the 1989 Agreement is 549.5 metres (1802.8 feet).

Alameda Reservoir was at an elevation of 561.0 metres (1,840.50 feet) on February 12, 2016. The maximum elevation for February 1, 2016, as specified by the 1989 Canada-United States Agreement, is 561.0 metres (1,840.53 feet).

The Saskatchewan Water Security Agency spring runoff forecast as of February 15, 2016, assumed average precipitation for February, March and April and a normal melt. No additional pre-runoff flood operation drawdowns, beyond the normal drawdowns, were required. Based on the projected runoff volumes, the apportionment split was determined to be 60/40 according to Annex B of the 1989 International Agreement.

There were questions from the public about better monitoring and reporting of flow data to downstream communities, such as Minot. There were complaints about extended flooding of hay lands in the US portion of the basin. It was noted that the frozen ground with little snow cover caused flooding problems in 2015. The current models cannot handle this condition.

The National Weather Service explained how El Nino (Southern Oscillation) is influencing precipitation patterns in the basin. The winter of 2015 going into 2016 was warm and dry with very little snow cover in most of the basin. January temperatures were 6-9 degrees Celsius above normal.

El Nino was expected to continue throughout April. Normal precipitation conditions are expected after that. The other phenomenon La Nina, which brings cooler winter conditions, is expected to return in the fall of 2016. The forecast for spring is well below normal flow conditions with very low risk of flooding.

The Canadian reservoirs are not expected to fill in 2016.

The Manitoba portion of the Souris River Basin has received below normal snow cover in winter 2015 to 2016. Winter Souris River flows were at above normal levels in the early winter period to mid-January. Since then, flows have been in the normal range. The current flow at Wawanesa was approximately 0.9 cubic metres per second (32 cubic feet per second).

The Antecedent Precipitation Index (API) for the Manitoba portion of the Souris River Basin is normal to above normal. The API is a comparison of current precipitation from May to freeze-up to the historical record. Total precipitation from November 1 to February 20 has been below normal for the Manitoba portion of the basin. Manitoba Infrastructure and Transportation's Hydrologic Forecasting Centre has generated a map that shows the runoff potential for Spring 2016. Runoff potential for the Manitoba portion of the basin is below normal to normal.

Based on the foregoing agency reports, the Board declared Spring 2016 to be a non-flood event with normal to below normal runoff (less than 1:10 year event).

The Hydrology Committee is working on the Apportionment Procedures Manual for the Souris River and is progressing. The Committee plans to have another meeting in the near future and provided a current membership list to the Board.

The USGS reported that the Water Quantity Monitoring Plans will operate as they have in the past with no changes.

Environment and Climate Change Canada and the Water Security Agency reported no major changes to their hydrometric network are planned. The network was reviewed in 2011 for flow forecasting purposes.

The National Weather Service presented the rationale for making the datum changes from the old NAD-29 to the new NAVD-88 system. There were concerns how the switch to the new datum will affect stations, particularly those with long records in the basin. Stages were rounded-up instead of down. As a result, some minor differences were noted from a quarter of a foot to a foot and a half. Concerns were expressed over possible misunderstandings of the public and how they may view the switch as well as how the change would affect existing Agreements. The Boundary Waters Treaty is written using the NAD-29 datum. In the long-term, it is expected that people would benefit from the new datum and it was suggested to involve the USFWS and the IJC, possibly incorporating the datum change in the new Plan of Study (POS).

Environment and Climate Change Canada (ECCC) reported that it is moving to the new Geoid 2013 datum, which uses a satellite system instead of ground-based monuments. The move to the Geoid 2013 is made by Natural Resources Canada and is a decision taken by the Federal Government of Canada, not ECCC. ECCC stated that they will not change their reporting procedures, but will convey the corrections for both datums.

There was agreement that the datum conversion needs more public discussion and engagement. Specially, public outreach and education is needed so that the public understands the benefits of the datum conversion. There are numbers in Annex "A" that are based on the NAD-29 Datum that need to be addressed.

In summary, there would be a new reference datum, which will have implications on the 1989 Agreement. Therefore, there is a need to reconcile the differences between the two datums. Agencies operating with licenses need to know which datum they must use for reporting purposes, which could be a challenge for those who regulate and manage reservoirs in the Souris River Basin. There is a need to document the NAD-29 datum used in the 1989 Agreement, which is not currently clearly stated. It was suggested that the 1989 Agreement has to clearly spell out the numbers in NAD-29, therefore, the Agreement needs to be modified.

Saskatchewan reported that there were 625 projects with issued licenses for water use for a total of 45 000 cubic decametres (36,496 acre-feet) in 2015. There were also three minor use water licenses approved for industrial use, municipal supply and track wash activities.

The North Dakota State Water Commission stated there were thirty-three temporary surface water permits and one temporary groundwater permit issued in 2015. The surface water allocation was 3 544 cubic decametres (2,874 acre-feet). The groundwater allocation was 62 cubic decametres (50 acre-feet) for a total of 3 605 cubic decametres (2,924 acre-feet). There was one conditional surface water permit issued in 2015 for 37 cubic decametres (30 acre-feet).

The Flow Forecasting Liaison Committee distributed handouts detailing work they performed, including runoff forecasts. There was discussion about IWI funding opportunities from the IJC to do research on forecasting tools.

The Aquatic Health Ecosystem Committee continue to work on the plan for investigating and revising water quality objectives. It also provided updates to the Communications Protocols for spills and fish kills in the Souris River and welcomed a new co-chair from Canada.

The Aquatic Ecosystem Health Committee (AEHC) provided a handout with an update on its activities and gave an overview of the Souris River Water Quality. Water quality samples have been collected from the two sites since 1960 that includes 47 parameters. Six water quality parameters continue to exceed their set objectives on a frequent basis. A similar pattern of exceedances is observed at the Sherwood and Westhope sites. The sampling schedule is 7-8 times per year; 6 during open water and 2 under ice conditions.

The parameters monitored include pH, conductivity, dissolved oxygen, nutrients, major ions, metals and organics for a total of 47 parameters. Water quality data are checked for compliance against water quality objectives. Water quality parameters can be affected by season and/or flow conditions, so interpretation of data must consider these factors.

Sodium in 2015 exceeded the objective in the majority of the samples. Total iron at Sherwood has historically been higher than the Westhope site, although the objective is exceeded at both stations. The reason is believed to be due to background source/levels. Sulphate levels at Sherwood and Westhope are below the objective of 450 mg/L. The same holds true for Total Dissolved Solids, which were below the objective of 1000 mg/L. pH is typically greater at the Westhope site. Higher levels of

molybdenum have been recorded during the spring at the Westhope site, which has an objective of 10 μg/L. The highest value recorded was 10.9 μg/L in June of 2015. Dissolved oxygen levels met the objectives in all samples at Sherwood, and in all but one sample at Westhope.

The AEHC is currently working on the wording for the addition of E. coli to the water quality objectives. Once completed, they will send it to the secretaries for distribution to Board members. The Spills Communication Protocol has been completed. The AEHC is also looking for alternates for ECCC. The AEHC would like to undertake a review of the current water quality objectives. However, review of the Water Quality Objectives has been put on hold for now, pending direction on process and allocation of appropriate resources. The AEHC is also planning to better understand the source of discrepancies between samples analyzed by the USGS versus ECCC. There was discussion on adding information related to invasive species in the Souris River watershed to the work of the AEHC. The AEHC is also working on changing the way data are presented for the next Annual Report. The Board agreed there was a desire to improve efficiency, communication, and presentation of its Annual Report and has decided to submit an IWI proposal for implementation.

The 1989 Agreement Core Committee gave a brief report on their activities. Currently, the 1989 Agreement Core Committee is looking at the language of both Annex A and Annex B dealing with flood and non-flood aspects of the 1989 Agreement. The Water Security Agency is working on the Canadian Reservoirs' Operations Manual and is close to completion. It will be presented to the United States Operators. Saskatchewan redid the Probable Maximum Flood (PMF) for the inflow design flood. The decision of the inflow design flood is expected in the next two months. Saskatchewan has also conducted a dam safety inspection using the Canadian Dam Safety Guidelines to ensure the safety of its dams.

A couple of editorials were made to the Plan of Study Committee Terms of Reference. It was decided not to make references to personal names. Names of agencies mentioned in the terms of reference (TOR) were corrected and language was simplified.

The Plan of Study review committee has met and gone through the entire proposed process. The path forward requires both internal and external resources. The Core Committee expects to draft its work plan by the end of April 2016. The IJC might help out with the study management. Communication and public outreach/engagement need to be included. The need for project management has been mentioned. The IJC stated that it is planning to push the POS forward.

The significance of climate change in Section 5 of the Plan of Study was highlighted. The need for long-term climate data and tree-ring data to better understand long-term precipitation patterns was mentioned as important information. Historic climate reconstruction done for Devils Lake could provide insight.

The Northwest Area Water Supply project is still before the courts in Washington D.C. and it is hoped there will be a ruling by the end of the year.

A brief report was given on the IJC initiatives. Current water quality objectives, which were developed in the early 1990s, are being reviewed. The purpose of the review is mainly for internal use by IJC/Commissioners to understand potential water quality issues in the basin, appropriateness of the current objectives and to recommend if changes are needed to the existing objectives. Findings will be presented to the Board at the summer meeting, who will then determine whether an update of objectives is warranted and make recommendations to the IJC. The IJC will then seek approval from

the two federal governments for developing and implementing the new water quality objectives. The Board was briefed about the Joint IWI Multi-Board Strategic Workshop that took place in October 2015 in Ottawa. The workshop discussed the need for a holistic watershed approach to solve problems in any given basin, and was designed to facilitate discussion and interaction with other boards.

There was discussion about improving the production of the ISRB Annual Report. The IJC Communications Team will provide assistance. The Board was encouraged to submit an IWI proposal that would also include updating/improving the website. The Communication piece and the Annual Report components will be circulated to the Board for input and comments, the Board has to approve the project before it is submitted to the IJC for funding.

The City of Minot made a presentation on the City of Minot HUD's National Disaster Resiliency Competition (NDRC). Minot was awarded $74.3 million in federal funding, one of only 13 grant awards. The direct leverage funds from the City of Minot, State of North Dakota, and area businesses was $469,985,350. The Board was thanked for its support letter that accompanied the City's application for the grants.

Three project activities were identified which included:

- Reducing flood risk and improving water management,
- Building affordable and resilient neighborhoods, and
- Fostering economic resilience diversification

The Assiniboine River Basin Initiative (ARBI) gave a presentation on their activities. After the severe flood of 2011, the ARBI was established in the fall of 2013 and consists of 51 members from each of the three jurisdictions; Saskatchewan, Manitoba, and North Dakota, and is incorporated in those jurisdictions. The goal of the ARBI is to facilitate and support a coordinated approach to water related issues in the basin. The ARBI was directed to contact Project WET, offered by the Canadian Water Resources Association (CWRA), for assistance in their educational and public awareness component. Project WET was originally started in North Dakota and has been very effective in raising environmental awareness/education among children from Kindergarten to Grade 12.

2.2 JUNE 14, 2016 MEETING IN MINOT, NORTH DAKOTA

Members in attendance were:

Russell Boals
Member for Canada

John Fahlman
Member for Canada

Mark Lee
Member for Canada

Todd Sando
Member for the United States

Ken Bottle
Member for the United States

Gregg Wiche
Member for the United States

Nicole Armstrong
Member for Canada

Jeff Woodward
Member for Canada

John-Mark Davies
Member for Canada

Debbie McMechan
Member for Canada

Scott Gangl
Member for the United States

Scott Jutila for Col Daniel Koprowski
Member for the United States

Lee Staab
Member for the United States

Lorinda Haman
Member for the United States

Shelly Weppler
Member for the United States

Todd Sando mentioned that this would be his last meeting and introduced his replacement as State Engineer and U.S. Co-Chair to the Board; Garland Erbele. The newest Public Board Member from Canada; Debbie McMechan, was introduced and provided additional background information on her appointment. Board members and other participants were invited to introduce themselves. It was also noted that Manitoba Conservation and Water Stewardship had changed their name to Manitoba Sustainable Development.

It was observed that the public had a great opportunity to present their concerns and have them validated at the public meeting held the day prior to the Board meeting. It was recognized that the previous day's tour was advantageous for providing insights into the public concerns and supplied a firsthand understanding for members of the Board.

Environment and Climate Change Canada, presented the results of the natural flow computations to May 31, 2016. The total diversion in the Souris River basin was 10 488 cubic decametres (8,506 acre-feet). Recorded flow at Sherwood was 16 746 cubic decametres (13,582 acre-feet). The natural flow computed at Sherwood was 27 234 cubic decametres (22,088 acre-feet). According to these computations, 50 000 cubic decametres (40,552 acre-feet) was not met, making it a 50/50 apportionment at the Sherwood crossing. The United States 50 percent share was 13 620 cubic decametres (11,046 acre-feet). The flow received by the US was 18 257 cubic decametres (14,807 acre-feet) and constitutes a surplus delivery of 4 637 cubic decametres (3,761 acre-feet). The annual flow requirement for Long Creek was met with a surplus of 1 055 cubic decametres (856 acre-feet). It was noted that the observed flows are well below the average and are close to the lower quartile historic flows.

The Hydrology Committee reported there was limited activity since the February meeting. Canada's representation on the committee requires a new member and a new Co-Chair. Nathalie Brunet was recommended for the position of Co-Chair and Bruce Davison was recommended to be placed on the Committee. The Operations Plan is currently being reviewed by Environment and Climate Change Canada and the placement of a Canadian Co-Chair on the Hydrology Committee will help the review. The Saskatchewan Water Security Agency reported that the fall was dry and there was very little snow over the winter, resulting in little runoff into all of the Canadian reservoirs. In May, there was 50 millimetres to 100 millimetres of rainfall, but of the precipitation was below the reservoirs. Rafferty Reservoir and Alameda Reservoir were both lowered to their respective winter drawdown level, which is 1.0 metre below full operation level, by February 1, 2016.

As of June 13, 2016, Rafferty Reservoir was at an elevation of 549.51 metres, 1.0 metre below full operating level. Alameda Reservoir was at an elevation of 561.58 metres, 0.42 metre below full operating level. Given that Canada was in a surplus delivery position and that Rafferty Reservoir was at its winter drawdown level for next winter, there are no planned releases until late fall. Saskatchewan Water Security suggest that they liaise with the United States Fish and Wildlife Service if there were any releases from Alameda Reservoir. It was noted that the basin had become much drier in comparison to last year and that the basin was drier towards the southeast and becomes wetter as one moves to the northwest.

The United States Geological Survey provided an update on the USGS Sherwood gage, with respect to the significant bank erosion at the gaging location. The North Dakota State Water Commission did an engineering study comparing the cost to fix the gage at its current location as opposed to moving it downstream three quarters of a mile. The cost to rip-rap the gage at its current location would be in excess of $500,000, while moving it downstream would cost between $150,000 and $200,000. Funding partners will be necessary to maintain the gage and its robust infrastructure.

The United States Geological Survey provided a summary of the 2016 flow conditions for the United States portion of the Souris Basin. According to the summary, the total volume of flow passing the Long Creek at Noonan gage through May 31, 2016 calendar year was 1 647 cubic decametres (1,336 acre-feet). This volume is about 8.2 percent of the median flow for the past 57 years. Flows for the current year are in the normal to above normal range. The peak discharge for the period January 1 to May 31, 2016, was 0.8 cubic metres per second (29 cubic feet per second), which ranks 51 in 57 years of record.

The United States Geological Survey reported that the total volume of flow passing the Souris River near Sherwood gage to May 31, 2016 calendar year was 16 739 cubic decametres (13,576 acre-feet). The calendar year's total flow to date was approximately 28.3 percent of the median flow for the past 86 years. Flows for the current year, based on the last 86 years of data were in the below normal to much above normal range. The peak discharge for the period January 1 to May 31, 2016 was 3.4 cubic metres per second (120 cubic feet per second), which ranks 79 in 86 years of record.

Flows recorded at the Souris River near Westhope gage exceeded the long-term mean for the period. The minimum discharge for the period January 1 to May 31, 2016 was 0.05 cubic metres per second (1.6 cubic feet per second) on March 30-31. The peak discharge for the period January 1 to May 31, 2016 was 8.7 cubic metres per second (308 cubic feet per second), which ranks 66 out of 87 years of record.

It was noted that if not for a rainfall event at the end of May, the Sherwood gage would have approached the 10 cubic feet per second range.

The National Weather Service reported that the basin is in a rapid transitioning period from an El Niño to La Niña weather pattern, but currently there is an equal chance of the climate going in either direction. In early June, there was two substantial rain events across the lower portion of the Souris River Basin, making up for the early snowmelts through winter that left a drier spring. The three-month outlook suggested higher than normal temperatures in the Midwest, though North Dakota may not see much above average weather. The climate should shift to a La Niña pattern by October. The fall outlook for the basin suggests lower than normal temperatures. There is; however, a positive Pacific Decadal Oscillation that will oppose the La Niña weather pattern, making climate predictions challenging. This climate condition suggests that there may be swings in the weather when one pattern has a stronger influence over the other.

Manitoba Sustainable Development reported precipitation for the Manitoba portion of the basin was normal to above normal. El Niño conditions caused well below normal snow cover over the winter, resulting in below normal spring runoff potential for the Manitoba portion of the basin. The 2016 spring peak flow of the Souris River at Wawanesa was approximately 15.6 cubic metres per second (550 cubic feet per second) on March 21st. This was well below the median annual peak flow and was exceeded in approximately 80 percent of the years on record.

Spring and early summer flows on the Souris River were below normal with flow fluctuating between the 25th percentile and median values. Precipitation was above normal for the month of May, improving dry conditions and the current flow at Wawanesa was approximately 16.3 cubic metres per second (575 cubic feet per second). The main stem of the Souris River was flowing at the median value while the tributaries were flowing below normal, but the recent June rain events were expected to increase the tributary flows back up to normal.

The United States Fish and Wildlife presented a summary of refuge operations and flows for the period January 1 to May 31, 2016. The total provisional inflow measured at Sherwood for the first five months of the year was 62 364 cubic decametres (50,579 acre-feet). This inflow was 16 percent of the historic January-May inflow. The total provisional outflow measured at Foxholm on the south end of the Upper Souris Refuge for the first five months of 2016 was 10 463 cubic decametres (8,482 acre-feet). This outflow was 12 percent of the historic record for the January-May outflow. Lake Darling elevation increased 0.04 metres (0.12 feet) from 568.33 metres (1595.93 feet) on January 1 to 568.37 metres (1596.05 feet) on May 31, 2016. Lake Darling was at 568.37 metres (1596.05 feet) on June 1st, 2016. Lake Darling did not meet its summer target and achieved a peak elevation of 568.43 metres (1596.20 feet). No future releases are planned at this time, unless conditions warrant otherwise. Dam 96 emergency spillway has some integrity issues and Pool 96 will be kept approximately 0.53 metres (1.5 feet) lower than crest spillway elevation.

The total provisional flow measured from the Souris River to the J. Clark Salyer Refuge from January 1 through May 31, 2016 was 34 882 cubic decametres (28,279 acre-feet). This was 26 percent of the historic January-May inflow. The total outflow measured at Westhope for 2016 was 54 482 cubic decametres (44,169 acre-feet).

The USFWS was in the process of working with Canada to minimize flows at Dam 357 during the last week of September in an effort to draw down Pool 357 as much as possible to allow for repair to the low flow gate. The low flow gate received damage during the 2011 flood. During the repair period, there could be no flow to Manitoba.

The Flow Forecasting Liaison Committee provided an update on the spring forecast process. There was a collaboration on the three separate spring forecasts for February 1st, February 15th, and March 1st. Those forecasts did not change very much and all correspondence was done over email rather than hosting conference calls. At the last meeting, a forecast process and integrated communication plan was presented.

The Flow Forecasting Liaison Committee received commendations and was reminded that the committee served the purpose of flow forecasting, which included periods of high flow as well as for periods of little to no flow.

The Aquatic Ecosystem Health Committee held two conference calls to discuss the Section V summary of the IJC Report for the Water Quality Objectives to formulate action items for the next year. A committee meeting was held on June 13, 2016, to review the activities of the AEHC. The Summary for Section V of the IJC Water Quality Objectives report had been drafted and was presented at this meeting. The summary was intended to provide short and long-term goals for the objectives and concerns that the Board may have. The AEHC reported that it was preparing a draft outline for the review process that is supposed to be completed every five years. The outline is intended to be a guide for the process of identifying data gaps, short and long-term goals and funding requirements.

A request for the addition of an E. coli objective was sent to the IJC for approval. The current bacterial water quality objective is based on Fecal Coliform counts. Current research suggests that E. coli, a form of fecal coliform, is a better indicator for where there may be human health concerns. North Dakota, Saskatchewan and Manitoba have already begun using E. coli as an indicator in jurisdictional objectives. The AEHC investigated objectives and guidelines from Manitoba, Saskatchewan, and ECCC and standards from North Dakota, and the EPA, then determined values for an E. coli objective to be included in the current list of Water Quality Objectives for border locations. The objective would be two tier; the first proposed objective is 129 units (colony forming units, CFU or most probably number, MPN) per 100 millilitres as a seasonal geo-mean with no less than five samples. The second objective would be a maximum of 400 units per 100 millilitres. The addition of the E. coli objective would not take away the Fecal Coliform testing, the Fecal Coliform would be placed in an archive file.

The AEHC reported that the Spill Communication Protocol was updated with alternates and was distributed. The Spill Communication Protocol is intended as a communication document between jurisdictions and not an emergency response document.

The Aquatic Ecosystem Health Committee presented a summary of the water quality monitoring program. A total of eight samples were collected by Environment and Climate Change Canada in 2015 – seven samples were collected at Westhope (triplicate in March, April, May, June, July, September and October) and one joint sample was collected with the USGS at Sherwood (triplicate in September).

The highlights included:

- Total Phosphorus exceeded its Water Quality Objective of 0.10 mg/L for all samples collected in 2015. Values ranged from 0.126 mg/L on May 14 to 0.328 mg/L on April 14 at Westhope.

- Sodium exceeded its objective of 100 mg/L for 5 of the 7 samples collected in 2015. Results ranged from 81.6 mg/L on September 1 to 185 mg/L on March 5.

- Sulphate exceeded its objective of 450 mg/L in 4 samples collected in 2015. The maximum concentration of 544 mg/L was observed on March 5. Concentrations were under the objective value in April and May, but near or exceeding the objective value in all remaining samples.

- Total Dissolved Solids exceeded the Water Quality Objective of 1000 mg/L three times with a maximum value of 1349 mg/L. The minimum value was 690 mg/L, observed on April 4.

- Total iron exceeded its water quality objective of 300 μg/L three times in 2015, with a maximum value of 602 μg/L on April 14.

- pH exceeded its Water Quality objective of 8.5 units in 6 of the 7 samples. The maximum value of 9.13 was observed on September 1.

- The Dissolved Oxygen (DO) concentration was at or above the 5 mg/L Water Quality Objective for all samples in 2015, with the exception of one sample with a value of 4.91 on March 5 at Westhope.

- Fecal coliform did not exceed its Water Quality Objective of 200 no. /100mL in 2015.

- E. coli did not exceed its proposed Water Quality Objective of 129 no. /100mL in 2015.

- Chloride did not exceed the Water Quality objective of 100 mg/L in 2015.

- Total Boron did not exceed its objective of 0.50 mg/L in 2015.

It was noted that pesticide sampling was added, and that the North Dakota Department of Agriculture does a statewide pesticide sampling program with sites along the Souris River including at Sherwood. They tested for 101 different pesticides with 92 of them being non-detects. Of the nine detected pesticides, only four were detected in more than one sample and the values were at trace levels and non-persistent throughout the sampling period.

Environment and Climate Change Canada normally does pesticide sampling, but there were issues and data could not be provided from 2015. Environment and Climate Change Canada is expected to resume pesticide sampling in 2016.

It was noted that investigations, either through literature review or collecting data, involving exceedances would be an excellent next step in the process.

The International Joint Commission provided an overview of the status of the Water Quality Objective Review and Report. The report is planned for IJC internal use and will be used to communicate a better understanding of Water Quality Objectives to the Governments and Boards. It was noted that the Water Quality Objectives review provides a great foundation and hopefully data collection will evolve over time to provide indicators of changes that may have occurred. This information may assist the Board to identify causes and effects in order to diagnose and maintain the health of the system.

The Board discussed possible implications and ramifications of using objectives verses indicators in the management of the watershed and the possible evolution or incorporation of objectives into indicators.

An IWI Multi-Board Workshop was held in the spring of 2016 in Washington D.C. Members from Boards were brought together to discuss the impacts of climate change on transboundary issues. The summary workshop was distributed to the Co-Chairs and Secretaries.

The Souris River Basin is unique in the tremendous amount of variability that occurs, causing the basin to deal with climate change issues as a natural mechanic of how the basin functions. The Board has a lot to offer to the process of climate change risk identification and assessment as well as coordinating data between jurisdictions.

The Board was thanked for submitting their IWI Proposal, but unfortunately it was found not to fit within IWI goals. The proposal, titled; "International Souris River Board Annual Report Improvements", was intended to automate portions of the yearly report in order to lessen the workload of the creation of the report.

It was noted that the Aquatic Ecosystem Health Committee was working on a proposal for IWI consideration. Also, that discussions were being made regarding public education and engagement and the possible ways to formulate and initiate procedures for doing so.

The Core Committee reported that the development of the Reservoir Regulation Manuals for Canadian reservoirs had been submitted to the Canadian Government for review and it is hoped that comments would be received by the end of the year.

The Army Corps of Engineers, United States Fish and Wildlife Service, Water Security Agency of Saskatchewan, and Manitoba Sustainable Development met in Denver in April to review the language of the 1989 Agreement and to suggest wording updates or correction as needed.

The Core Committee and Plan of Study Committee was thanked for cataloging the work that had been completed to date with respect to the scope of the Plan of Study.

It was noted that the International Souris River Board has had discussions about the Plan of Study moving forward and petitioned the IJC for the Board to have a very strong role in the management of the Plan of Study, which would involve more than an advisory review.

The Northwest Area Water Supply project is still before the courts in Washington D.C. and it is hoped to have a ruling by the end of the year.

CDM Smith presented a Decision Support Tool that encompasses the entire Souris River Basin. The DS Tool is a STELLA modeling tool that includes the mainstem of the Souris River, its tributaries, reservoirs and refuges and includes operating agreements, the effects of agriculture, rural and city developments and how to address potential climate change. The model is essentially the culmination of all available data for the basin and will be used to determine how changes at a point, portion, or basin level will affect the entirety of the basin and perform a cost/benefit analysis to determine if proposed projects are worth the investment. The model will also look at efficiencies in development in the basin and how to efficiently use natural changes that may occur. This project is being developed as part of the City of Minot's Natural Disaster Resilience Competition Grant.

It was noted that the DS Tool aligned very well with projects proposed in the Plan of Study and that when the Plan moves forward the Board will have further conversations with the City of Minot, who owns the intellectual property.

3.0 MONITORING

3.1 INSPECTIONS OF THE BASIN

During 2016, the staff of the Water Survey Division of Environment and Climate Change Canada, Saskatchewan Water Security Agency, the North Dakota State Water Commission, Manitoba Sustainable Development, and the United States Geological Survey carried out frequent field inspections of the Souris River basin.

3.2 GAUGING STATIONS

A list of the gauging stations being operated in the Souris River basin is given in Table 1. In addition, the United States Geological Survey operated three miscellaneous stream flow-measurement sites in the vicinity of the Eaton Irrigation Project near Towner, North Dakota.

The station numbers and the locations of the hydrometric stations measuring streamflow are shown in Part I of Table 1. The gauging station numbers and the locations of the hydrometric stations located on lakes and reservoirs in the basin are shown in Part II of Table 1.

Table 1.
STREAMFLOW, WATER-LEVEL, AND WATER QUALITY STATIONS
IN THE SOURIS RIVER BASIN
Part I--Streamflow

Index Number	Stream	Location	State or Province	Operated By
05NA003 (5113360)	Long Creek[1]	at Western Crossing	Saskatchewan	Environment and Climate Change Canada
05NA004	Long Creek	near Maxim	Saskatchewan	Saskatchewan Water Security Agency
05NA005	Gibson Creek	near Radville	Saskatchewan	Environment and Climate Change Canada
05NB001	Long Creek	near Estevan	Saskatchewan	Environment and Climate Change Canada
05NB011	Yellowgrass Ditch	near Yellowgrass	Saskatchewan	Environment and Climate Change Canada
05NB014	Jewel Creek	near Goodwater	Saskatchewan	Environment and Climate Change Canada
05NB018	Tatagwa Lake Drain	near Weyburn	Saskatchewan	Environment and Climate Change Canada
05NB021 (5113800)	Short Creek[1]	near Roche Percee	Saskatchewan	Environment and Climate Change Canada
05NB031	Souris River	near Bechard2	Saskatchewan	Saskatchewan Water Security Agency
05NB033	Moseley Creek	near Halbrite	Saskatchewan	Environment and Climate Change Canada
05NB034	Roughbark Creek	near Goodwater	Saskatchewan	Environment and Climate Change Canada
05NB035	Cooke Creek	near Goodwater	Saskatchewan	Environment and Climate Change Canada
05NB036	Souris River	below Rafferty Reservoir	Saskatchewan	Environment and Climate Change Canada
05NB038	Boundary Reservoir Diversion Canal	near Estevan	Saskatchewan	Environment and Climate Change Canada
05NB039	Tributary	near Outram	Saskatchewan	Environment and Climate Change Canada
05NB040	Souris River	near Ralph	Saskatchewan	Environment and Climate Change Canada
05NB041	Roughbark Creek	above Rafferty Reservoir	Saskatchewan	Environment and Climate Change Canada
05NC001	Moose Mountain Creek	below Moose Mountain Lake	Saskatchewan	Saskatchewan Water Security Agency
05ND010	Moose Mountain Creek	above Alameda Reservoir	Saskatchewan	Environment and Climate Change Canada
05ND011	Shepherd Creek	near Alameda	Saskatchewan	Environment and Climate Change Canada

05ND013	Moose Mountain Creek	below Alameda Reservoir	Saskatchewan	Environment and Climate Change Canada
05NE003	Pipestone Creek	above Moose Mountain Reservoir	Saskatchewan	Environment and Climate Change Canada
05NF001	Souris River	at Melita	Manitoba	Environment and Climate Change Canada
05NF002	Antler River	near Melita	Manitoba	Environment and Climate Change Canada
05NF006	Lightning Creek	near Carnduff	Saskatchewan	Environment and Climate Change Canada
05NF007	Gainsborough Creek	near Lyleton	Manitoba	Environment and Climate Change Canada
05NF008	Graham Creek	near Melita	Manitoba	Environment and Climate Change Canada
05NF010	Antler River	near Wauchope	Saskatchewan	Environment and Climate Change Canada
05NG001	Souris River	at Wawanesa	Manitoba	Environment and Climate Change Canada
05NG003	Pipestone Creek	near Pipestone	Manitoba	Environment and Climate Change Canada
05NG007	Plum Creek	near Souris	Manitoba	Environment and Climate Change Canada
05NG012	Elgin Creek	near Souris	Manitoba	Environment and Climate Change Canada
05NG020	Medora Creek	near Napinka	Manitoba	Environment and Climate Change Canada
05NG021	Souris River	at Souris	Manitoba	Environment and Climate Change Canada
05NG024	Pipestone Creek	near Sask. Boundary	Manitoba	Environment and Climate Change Canada
5113520	Long Creek Tributary	near Crosby	North Dakota	United States Geological Survey
5113600 (05NB027)	Long Creek[1 3]	near Noonan	North Dakota	United States Geological Survey
5114000 (05ND007)	Souris River[1 3]	near Sherwood	North Dakota	United States Geological Survey
5116000	Souris River[3]	near Foxholm	North Dakota	United States Geological Survey
5116135	Tasker Coulee Tributary	near Kenaston	North Dakota	United States Geological Survey
5116500	Des Lacs River[3]	at Foxholm	North Dakota	United States Geological Survey
5117500	Souris River[3]	above Minot	North Dakota	United States Geological Survey
5119410	Bonnes Coulee	near Velva	North Dakota	United States Geological Survey
5120000	Souris River[3]	near Verendrye	North Dakota	United States Geological Survey
5120180	Wintering River Tributary	near Kongsberg	North Dakota	United States Geological Survey
5120500	Wintering River[3]	near Karlsruhe	North Dakota	United States Geological Survey
5122000	Souris River[3]	near Bantry	North Dakota	United States Geological Survey
5123300	Oak Creek Tributary	near Bottineau	North Dakota	United States Geological Survey
5123400	Willow Creek[3]	near Willow City	North Dakota	United States Geological Survey
5123510	Deep River[3]	near Upham	North Dakota	United States Geological Survey
5124000 (05NF012)	Souris River[1 3]	near Westhope	North Dakota	United States Geological Survey

Table 1.
STREAMFLOW, WATER-LEVEL, AND WATER QUALITY STATIONS
IN THE SOURIS RIVER BASIN
Part II--Water Level

Index Number	Stream	Location	State or Province	Operated By
5113750	East Branch Short Creek Reservoir	near Columbus	North Dakota	United States Geological Survey
5115500	Lake Darling	near Foxholm	North Dakota	United States Geological Survey
LGNN8	Souris River	at Logan	North Dakota	United States Army Corps of Engineers United States National Weather Service
SWRN8	Souris River	at Sawyer	North Dakota	United States Army Corps of Engineers United States National Weather Service
TOWN8	Souris River	at Towner	North Dakota	United States Army Corps of Engineers United States National Weather Service
VLVN8	Souris River	at Velva	North Dakota	United States Army Corps of Engineers United States National Weather Service
	Upper Souris Refuge	Dams 87 and 96	North Dakota	United States Fish and Wildlife Service
	Des Lacs Refuge	Units 1 - 8 inclusive	North Dakota	United States Fish and Wildlife Service
	J. Clark Salyer Refuge	Dams 320, 326, 332, 341, and 357	North Dakota	United States Fish and Wildlife Service
05NA006	Larsen Reservoir	near Radville	Saskatchewan	Environment and Climate Change Canada
05NB012	Boundary Reservoir	near Estevan	Saskatchewan	Saskatchewan Water Security Agency
05NB016	Roughbark Reservoir	near Weyburn	Saskatchewan	Environment and Climate Change Canada
05NB020	Nickle Lake	near Weyburn	Saskatchewan	Environment and Climate Change Canada
05NB032	Rafferty Reservoir	near Estevan	Saskatchewan	Environment and Climate Change Canada
05NC002	Moose Mountain Lake	near Corning	Saskatchewan	Environment and Climate Change Canada
05ND008	White Bear (Carlyle) Lake	near Carlyle	Saskatchewan	Saskatchewan Water Security Agency
05ND009	Kenosee Lake	near Carlyle	Saskatchewan	Saskatchewan Water Security Agency
05ND012	Alameda Reservoir	near Alameda	Saskatchewan	Environment and Climate Change Canada
05NE002	Moosomin Lake	near Moosomin	Saskatchewan	Environment and Climate Change Canada
05NF804	Metigoshe Lake	near Metigoshe	Manitoba	Manitoba Sustainable Development
05NF805	Sharpe Lake	near Deloraine	Manitoba	Manitoba Sustainable Development
05NG023	Whitewater Lake	near Boissevain	Manitoba	Environment and Climate Change Canada
05NG801	Plum Lake	above Deleau Dam	Manitoba	Manitoba Sustainable Development
05NG803	Elgin Reservoir	near Elgin	Manitoba	Manitoba Sustainable Development
05NG806	Souris River	above Hartney Dam	Manitoba	Manitoba Sustainable Development
05NG807	Souris River	above Napinka Dam	Manitoba	Manitoba Sustainable Development
05NG809	Plum Lake	near Findlay	Manitoba	Manitoba Sustainable Development
05NG813	Oak Lake	at Oak Lake Resort	Manitoba	Manitoba Sustainable Development
05NG814	Deloraine Reservoir	near Deloraine	Manitoba	Manitoba Sustainable Development

Table 1.
STREAMFLOW, WATER-LEVEL, AND WATER QUALITY STATIONS
IN THE SOURIS RIVER BASIN
Part III--Water Quality

Index Number	Stream	Location	State or Province	Operated By
5114000 (05ND007)	Souris River[1] [3]	near Sherwood	North Dakota	United States Geological Survey
5115500	Lake Darling	near Foxholm	North Dakota	United States Geological Survey
5116000	Souris River[3]	near Foxholm	North Dakota	United States Geological Survey
5116500 (380021)	Des Lacs River[3]	at Foxholm	North Dakota	United States Geological Survey and North Dakota Department of Health
5117500 (380161)	Souris River[3]	above Minot	North Dakota	United States Geological Survey and North Dakota Department of Health
5120000 (380095)	Souris River[3]	near Verendrye	North Dakota	United States Geological Survey and North Dakota Department of Health
5122000	Souris River[3]	near Bantry	North Dakota	United States Geological Survey
5123400	Willow Creek[3]	near Willow City	North Dakota	United States Geological Survey
5123510	Deep River[3]	near Upham	North Dakota	United States Geological Survey
	J. Clark Salyer Refuge	Pool 357	North Dakota	United States Fish and Wildlife Service
5124000 (05NF012)	Souris River[1] [3]	near Westhope (QA)	North Dakota	United States Geological Survey

[1] International gauging station

[2] Formerly published as Souris River below Lewvan

[3] Operated jointly for hydrometric and water-quality monitoring

4.0 TRANSBOUNDARY WATER QUALITY OBJECTIVES AND MONITORING

The water quality of the Souris River at the International Boundary has been monitored by the International Souris River Board (formally the Souris River Bilateral Water Quality Monitoring Group) since 1990. The two sites are located at the Saskatchewan/North Dakota border near Sherwood, ND, and at the North Dakota/Manitoba border near Westhope, ND.

The Aquatic Ecosystem Health Committee held two conference calls to discuss Section V of the IJC Report for the Water Quality Objectives and to formulate action items for the next year. A committee meeting was held in June to review the activities of the AEHC.

4.1 OVERVIEW OF WATER QUALITY

The water quality of the Souris River at the International Boundary has been monitored by the International Souris River Board (formally the Souris River Bilateral Water Quality Monitoring Group) since 1990. The two sites are located at the Saskatchewan/North Dakota border near Sherwood, ND, where data is collected by the U.S. Geological Survey, and at the North Dakota/Manitoba border near Westhope, ND, where data is collected by Environment and Climate Change Canada.

Water quality objectives are established for the two border crossings. When water quality objectives are not achieved, such conditions are referred to as “exceedances”. A summary of water quality exceedances for 2016, along with historical data, is reported in Appendix E.

Historically, the principal concerns regarding water quality in the Souris River basin are related to high total dissolved solids (TDS), depleted dissolved oxygen, and high levels of nutrients, especially phosphorus. High TDS increases the hardness of water and can cause scale build up in pipes and filters. At higher levels, TDS can also affect aquatic life, especially spawning fish and juveniles. Low dissolved oxygen levels, or hypoxia, can result in the death of fish and other aquatic life and mobilize trace metals. High nutrient levels of phosphorus can cause algae blooms, which depending on how blooms form and ultimately decompose can lead to reductions in dissolved oxygen. High nutrient levels are also associated with the greater prevalence of cyanobacteria (blue-green algae), which under certain conditions can produce toxins that are harmful to humans and animals.

At the Saskatchewan/North Dakota border crossing in Sherwood, the United States Geological Survey (USGS) conducted water quality sampling eight times in 2016. At the North Dakota/Manitoba border crossing in Westhope, the USGS collected one sample in 2016 simultaneously with Environment and Climate Change Canada to compare sampling methods. Environment and Climate Change Canada conducted water quality sampling eight times in 2016 at the North Dakota/Manitoba border crossing.

A summary of 2016 water quality findings for the Sherwood site, where the Souris River crosses the border from Saskatchewan into North Dakota, is as follows. Compared to the four years previous to 2016, the median and maximum values decline for many metals (beryllium, cadmium, chromium, cobalt, copper, zinc, iron and lead), with zinc, iron and lead having significant decreases. Of all metals, only the total iron value was greater than the Water Quality Objective, although its median 2016 concentration of 524 was also lower than the median value of 1,860 μg/L in 2013.

Chloride and sodium have both seen increases in median value over the last four years. Chloride has remained below Water Quality Objectives, but sodium has continued to have more exceedances of the Objectives each year, with 75 percent of the 2016 samples exceeding the objective. Sulfate values are similar to previous years, though the number of samples exceeding water quality objectives has dropped slightly to 13 percent. There was 13 percent exceedance of total dissolved solids, which is similar to previous years.

This is the third year E. coli bacteria samples have been analyzed, and while values are below the proposed Water Quality Objective, they have been increasing as more samples are collected. While dissolved oxygen has historically been a constituent of concern, this year again it was above the water quality objective for all samples. Dissolved Oxygen values ranged from 6.5 milligrams per litre to 13 milligrams per litre. A concentration of less than 5.0 milligrams per litre is considered to not meet its objective. For nutrients like phosphorus and nitrogen, median and maximum values for 2016 are well below the historic median and maximum values, though total phosphorus samples still have a 63% exceedance of its water quality objective.

Pesticide samples were also collected as a part of an intensive statewide study conducted by the North Dakota Department of Agriculture. Ninety-eight pesticides were tested and none were above the water quality objectives, or for those not part of routine testing, none were above either aquatic life benchmarks of human health limits. Three pesticides (2,4-D, Atrazine, and MPCA) had positive, though very low results. When analyzing the data for this report, some anomalies were found in the historic data, so for this report the Historic Data column in the appendix only includes 4 years of data from 2013 to 2016. This issue will be resolved for the 2017 report.

For the Westhope site, where the Souris River crosses from North Dakota into Manitoba, exceedances of specific water quality objectives included total phosphorus, sodium, sulphate, total dissolved solids, total iron, pH, and fecal coliform bacteria. Total phosphorus did not meet water quality objectives in any of the eight samples. Sodium exceeded the water quality objective in 100 percent of the samples and total dissolved solids exceeded the water quality objective in 25 percent of the samples. Sulphate sample values can fluctuate from year to year, but usually have a 13 percent exceedance rate, as they do in 2016. The iron objective was exceeded in seven of eight samples in 2016, which is very unusual for this site, but may have something to do with the excess rainfall and supersaturated ground in the area. pH exceeded the objective five times in 2016, but the values are consistent with historical data for the Westhope site. Fecal coliform exceeded the 200 colonies per 100 millilitres objective once with a value of 1900 colonies per 100 millilitres.

Pesticide samples were collected between May and October, excluding August in 2016. Atrazine, Bromoxynil, MCPA and 2,4-D were detected, but at levels well below their water quality objectives. Picloram exceeded the guideline of 50 ng/L in May, June, and July.

4.2 CHANGES TO POLLUTION SOURCES IN 2016

Development in the Saskatchewan/North Dakota region of the basin in connection with the oil play in the Bakken Formation has the potential to increase areas that are susceptible to erosion. However, 2015 and 2016 saw decreasing growth of the oil and gas industry in this area. The continuing decrease in oil prices lead to fewer new wells being constructed and most of the production moving south, out of the Souris River basin to a more cost-effective portion of the Bakken formation.

Oil development and production has the potential of increasing storm water pollution through increases in erosion and can cause a variety of water quality impairments. However, the most prevalent source of pollution is still nonpoint source pollution arising from other sources.

The Souris River basin typically experiences short duration but intense precipitation during the spring and early summer months. These storms can cause overland flooding and rising river levels. Cropping practices that don't use soil and water conservation methods and livestock grazing near and watering in the river are the likely sources of excessive nutrient, sediment, and E. coli bacteria concentrations, along with laying the groundwork for dissolved oxygen depletion. However, this has been lessened in recent years by the installation of animal waste systems and Best Management Practices on agricultural land through a variety of watershed improvement projects throughout the basin on both sides of the border.

Dams frequently have a substantial additive effect on phosphorus loading. Large reservoirs with hypolimnetic releases can contribute to higher phosphorus loads; however, reservoirs in the Lake Winnipeg basin have been shown to sequester large proportions of nutrients and decrease downstream nutrient loads. The reservoirs and dams can become anoxic near the bottom during the winter, which can increase phosphorus release from sediments. Nutrient concentrations at the border sites have historically been above the current objective. The continual release of water throughout the year from the large upstream reservoirs seems to have lowered nutrient levels.

Point sources pollution from the cities of Estevan and Minot have been reduced by advanced wastewater treatment. Smaller cities continue to discharge effluent intermittently. All wastewater treatment lagoons in North Dakota are required in their permit to meet the State's water quality standards at the point of discharge. These standards are protective of the objectives set up by the International Souris River Board.

Future impacts to water quality and aquatic ecosystem health included changing agriculture and landscape, urban development, energy development, water appropriations that reduce flows and reservoir operations.

4.3 CHANGES TO MONITORING

There are no changes to the monitoring plan for 2017. The 2017 monitoring plan can be found in Appendix F.

4.4 WINTER ANOXIA

Winter hypoxia and anoxia and associated fish kills are the result of very low concentrations dissolved oxygen that have been documented in the Souris River basin on many occasions in previous years. Factors contributing to low oxygen levels have not been definitively determined, but are thought to be due to relatively high sediment oxygen demand relative to the volume of liquid water between the ice and sediment (as determined in North Dakota's 2010 Total Maximum Daily Load report on the reach of the Souris River from Sherwood to Lake Darling), low flow conditions, macrophyte decomposition, organic enrichment, photosynthesis suppression under ice and snow, scouring of low head dams during high flow events, and low-level drawdowns in reservoirs.

Dissolved oxygen concentrations at both monitoring stations met the water quality objective of 5.0 milligrams per litre for all samples throughout 2016, except for one low value of 2.63 milligrams per litre at Westhope in January. To better determine the minimum flow needed to protect these levels, the Board agrees to keep a watch on dissolved oxygen conditions and the USGS and Environment and Climate Change Canada will attempt to collect dissolved oxygen and ammonia samples when low flow conditions occur in future winters.

5.0 WATER-DEVELOPMENT ACTIVITIES IN 2016

5.1 NORTHWEST AREA WATER SUPPLY PROJECT

The Garrison Diversion Municipal, Rural, and Industrial (MRI) water-supply program, passed by the United States Congress on May 12, 1986, as part of the Garrison Diversion Reformation Act of 1986, authorized the appropriation of federal funds for the planning and construction of water-supply facilities throughout North Dakota. An agreement between the North Dakota State Water Commission and the Garrison Conservancy District in 1986 provided a method through which the agencies can request funding for MRI water-system projects from the Secretary of the Interior. On the basis of this agreement, the Northwest Area Water Supply (NAWS) study was initiated in November 1987. The NAWS project has been designed to supply a reliable source of treated water to cities, communities, and rural water systems in 10 counties in northwestern North Dakota. The project has an estimated cost of $217 million.

The water supply for the project is Lake Sakakawea, located in the Missouri River system. The annual use authorized under the State of North Dakota water permit is 18 502 cubic decametres (15,000 acre-feet).

Canada is concerned that the NAWS project could permit the interbasin transfer of non-native biota. NAWS would be the first project to divert water across the continental divide to the Hudson Bay drainage basin.

The Province of Manitoba filed suit in U.S. District Court. The court required the project undergo further NEPA review, and placed an injunction on the project.

On April 15, 2005, the Court modified the injunction to allow the construction on the pipeline between Lake Sakakawea and Minot to continue.

On March 24, 2006, the Court modified the injunction to allow additional construction of the Minot High Service Pump Station, the pipeline from the High Service Pump Station to the northern part of the City of Minot, and the pipeline to Berthold to proceed. It was determined that this construction would not affect treatment decisions. Design work on these projects was completed in 2006 and contract awards were made in 2007 and 2008. All 45 miles of this pipeline were completed by the summer of 2008. Berthold started receiving water in August 2008. The High Service Pump Station started operating in December 2009.

On March 18, 2008, the Court again modified the injunction to allow additional design and construction activities for the entire Northern Tier for features not affecting treatment decisions. The Kenmare-Upper Souris project started serving water in December 2009. The NAWS-All Seasons-Upham pipeline started serving water in September 2009. The Mohall-Sherwood-All Seasons pipeline has planned completion in Spring 2012. The Minot Air Force Base pipeline and the Upper Souris-Glenburn segment north of the Air Force Base have planned completion in 2012. Berthold, the Kenmare-Upper Souris project, and the NAWS-All Seasons-Upham pipeline are currently receiving limited water supply from the Minot and Sundre aquifers.

The construction activity in 2012 revolved around three contracts that were delayed by the flooding in 2011. Two are pipeline contracts connecting Minot's North Hill, the Minot Air Force Base, Glenburn,

Upper Souris Water Users System II water treatment facility three miles north of Glenburn, and two connections for the North Prairie Rural Water System to the NAWS project. These projects were completed.

The other contract was for the rehabilitation of the filter bays and associated piping at the Minot Water Treatment Plant Filtration Upgrades as well as the control instrumentation and SCADA (telemetry) for the entire North Tier project works which were operational by the end of 2012 with substantial completion shortly thereafter.

In 2012, 475 million gallons of potable water were distributed to customers through the NAWS project.

Work continued on the Supplemental Environmental Impact Statement with the Bureau of Reclamation and their consultant, CardnoENTRIX. A status update was provided to the Federal Court in October 2013.

The Bureau of Reclamation published the NAWS draft Supplemental Environmental Impact Statement in July of 2014.

5.2 WATER APPROPRIATIONS

5.2.1 Background

In 1995, the International Souris River Board adopted a new method for reporting minor project diversions for the purpose of determining apportionment. The new method uses a common set of criteria and ensures that the same criteria will be used in both Saskatchewan and North Dakota. It also involves taking the project lists generated by the Natural Flow Methods Committee and adding newly constructed projects or subtracting cancelled projects each year. The projects that met the criteria in 1993 are the benchmark for all future reporting.

5.2.2 Saskatchewan

In 1993 there were 137 minor projects in the Saskatchewan portion of the Souris River basin that met the new criteria. These projects had an annual diversion of 5 099 cubic decametres (4,134 acre-feet). In 2015, there were 625 projects in the Saskatchewan portion of the basin with an annual diversion of 45 000 cubic decametres (36,497 acre-feet). There were also three minor use water licenses approved for industrial use, municipal supply and track wash activity.

In 2016 there were 625 projects with issued licenses for water use for a total of 60 000 cubic decametres (48,662 acre-feet) in the Saskatchewan portion of the Basin. There was also one minor use water license approved for irrigation.

5.2.3 North Dakota

In 1993 there were 12 minor projects in the North Dakota portion of the Souris River basin upstream of Sherwood that met the new criteria. The projects had an annual diversion of 1 257 cubic decametres (1,019 acre-feet). As of December 31, 2016, there were 12 minor projects in the North Dakota portion of the Long and Short Creek basins. The annual diversions totaled 1 425 cubic decametres (1,154 acre-feet).

The diversion from East Branch Short Creek near Columbus, North Dakota, was estimated by correcting for precipitation, evaporation and seepage, and the storage change. The diversion in 2016 was 648 cubic decametres (525 acre-feet). The diversion from the reservoir was added to the minor project diversions for the Long and Short Creek basins to obtain the total diversion of 3 229 cubic decametres (2,619 acre-feet) by the United States.

6.0 HYDROLOGIC CONDITIONS IN 2016

The Saskatchewan Water Security Agency reported that winter 2015/2016 precipitation in the Saskatchewan portion of the Souris Basin was well below normal. Hydrologic conditions for the remainder of 2016 varied from slightly above normal in spring to near normal in the summer to well above normal by the fall as a result of near record rainfall accumulation in October. The estimated precipitation from April 1 to October 1 was 150-200 percent of normal.

The United States Geological Survey reported the total volume of flow past the Long Creek at Noonan gage through December 31, 2016 calendar year was 6 330 cubic decametres (5,132 acre-feet). The volume is about 33 percent greater than the median flow for the past 57 years. The peak discharge for the reporting period January 1 to December 31, 2016 was 10.9 cubic metres per second (384 cubic feet per second), which ranks 36 in 57 years of record.

On December 31, 2016, Rafferty Reservoir was at an elevation of 549.03 metres (1801.28 feet), or 0.592 metres (1.942 feet) lower than at the beginning of the year. Total inflow to Rafferty Reservoir in 2016 was 873 cubic decametres (708 acre-feet), and the calculated diversion for 2016 was 39 607 cubic decametres (32,123 acre-feet). No water was transferred from Rafferty Reservoir to Boundary Reservoir via the pipeline in 2016.

The main stem inflow to Alameda Reservoir (Moose Mountain Creek above Alameda Reservoir) was 12 200 cubic decametres (9,895 acre-feet), and the calculated diversion for 2016 was 4 806 cubic decametres (3,898 acre-feet). Alameda Reservoir was at an elevation of 561.16 metres (1,841.1 feet) on December 31, 2016, or 0.12 metres (0.39 feet) higher than at the beginning of the year.

Boundary Reservoir received an inflow of 6 325 cubic decametres (5,130 acre-feet) from Long Creek. The calculated diversion for 2016 was minus 3 817 cubic decametres (3,096 acre-feet). On December 31, 2016, Boundary Reservoir was at an elevation of 559.07 metres (1,834.23 feet), or 0.43 metres (1.42 feet) lower than at the beginning of the year.

On December 31, 2016, the estimated storage in the five major reservoirs in Saskatchewan (Boundary, Rafferty, Alameda, Nickle Lake, and Moose Mountain Lake) was 536 217 cubic decametres (434,888 acre-feet) as compared to storage of 564 390 cubic decametres (457,551 acre-feet) on December 31, 2015.

Figure 1 shows the storage contents of several reservoirs in the Canadian portion of the Souris River basin for 2015 and 2016.

Recorded runoff for the year for the Souris River near Sherwood was 41 291 cubic decametres (33,488 acre-feet), or about 63 percent of the 1931-2016 long-term mean. The artificially drained areas of Yellow Grass Ditch and Tatagwa Lake did not contribute during 2016. The peak discharge for the period January 1 to December 31 2016 was 7.4 cubic metres per second (260 cubic feet per second). Figure 2 provides a schematic representation of recorded runoff above Sherwood, North Dakota.

The United States Geological Survey reported the total flow in 2016 for the Souris River at Sherwood was 63 percent greater than the median flow for the past 86 years of record.

On December 31, 2016, the level of Lake Darling was 486.53 metres (1,596.24 feet). The 2016 year-end storage in Lake Darling was 125 325 cubic decametres (101,603 acre-feet), or approximately 3 633 cubic decametres (2,947 acre-feet) more than on December 31, 2015. The 2016 year-end storage in the J. Clark Salyer Refuge pools was 39 881 cubic decametres (32,345 acre-feet), or 6 264 cubic decametres (5,080 acre-feet) more than on December 31, 2015. The combined year-end storage in Lake Darling and the J. Clark Salyer Refuge pools was 165 206 cubic decametres (133,987 acre-feet), well above the 66 600 cubic decametres (54,000 acre-feet) severe drought criterion.

Figure 3 shows the storage contents of the mainstem reservoirs in the United States.

Recorded runoff for the year for the Souris River at Westhope was 113 772 cubic decametres (92,235 acre-feet) or some 72 481 cubic decametres (58,784 acre-feet) more than entered North Dakota at the Sherwood Crossing. The annual runoff for the Souris River near Westhope was 38 percent of the 1929-2016 long-term mean. The minimum flow for the period was 0.03 cubic metres per second (0.9 cubic feet per second), which occurred on March 31, 2016. The peak discharge for the period January 1 to December 31, 2016 was 11.2 cubic metres per second (396 cubic feet per second) which ranks 64 in 87 years of record.

Manitoba reported that El Niño conditions caused well below normal snow cover in 2015/2016 resulting in a well below normal spring runoff potential. The spring melt began in early March, earlier than usual. The melt produced very little runoff in the Manitoba tributaries. Spring and early summer flows were below normal. Above normal precipitation began in May resulting in flows that were normal to above normal at Wawanesa from July to freeze up.

Figure 4 shows the monthly releases from Boundary, Rafferty, Alameda, and Lake Darling Reservoirs.

7.0 SUMMARY OF FLOWS AND DIVERSIONS

7.1 SOURIS RIVER NEAR SHERWOOD

The natural runoff near Sherwood for 2016 was 47 925 cubic decametres (38,869 acre-feet). Depletions in Canada were 4 806 cubic decametres (3,897 acre-feet). No additional water was received from the Yellow Grass Ditch and Tatagwa Lake Drain basins. Total depletions in Canada were 4 806 cubic decametres (3,897 acre-feet) more than the additional water received from the Yellow Grass Ditch and Tatagwa Lake Drain basins. The total volume of water released from Boundary, Rafferty, and Alameda Reservoirs in Canada in 2016 was 19 600 cubic decametres (15,896 acre-feet), representing 47 percent of the recorded flow at Sherwood, or 41 percent of the computed natural runoff at Sherwood. A schematic representation of the 2016 flow volumes in the Souris River basin above Sherwood is shown in Figure 2 and the summary of the natural flow computations is provided in Appendix A. It should be noted that Saskatchewan was in surplus on December 31, 2016, by 19 159 cubic decametres (15,538 acre-feet).

The flow of the Souris River at Sherwood was more than 0.113 cubic metres per second (4 cubic feet per second) the entire year. Accordingly, Saskatchewan complied with the 0.113 cubic metres per second (4 cubic feet per second) provision specified in Recommendation No. 1 of the Interim Measures.

7.2 LONG CREEK AND SHORT CREEK

Recorded runoff for Long Creek at the Western Crossing as it enters North Dakota was 1 037 cubic decametres (841 acre-feet), or 3.3 percent of the long-term mean since 1959.

Recommendation No. 2 of the Interim Measures was met with the increase of runoff on Long Creek between the Western and Eastern Crossings of 5 288 cubic decametres (4,289 acre-feet).

Short Creek, which rises in North Dakota, contributed 4 186 cubic decametres (3,395 acre-feet) to runoff in the Souris River above Sherwood.

7.3 SOURIS RIVER NEAR WESTHOPE

Recorded flow near Westhope during the period of June 1 through October 31, 2016, was 47 179 cubic decametres (38,244 acre-feet). Figure 5 illustrates the recorded flows at Westhope and at Wawanesa near the mouth of the Souris River in Manitoba.

Due to ice conditions the flows in the Souris River near Westhope were estimated for the periods January 1 to March 17 and November 9 to December 31. The peak daily discharge of 11.3 cubic metres per second (396 cubic feet per second) occurred on March 23, and ranked 64th in 87 years of discharge record.

The flow at Westhope was not in compliance with the 0.566 cubic metres per second (20 cubic feet per second) minimum flow requirement as specified in Recommendation No. 3(a) of the Interim Measures for the period of October 18, 19, 20 and 23rd, due to wind fetch and minimal flows.

8.0 WORKPLAN SUMMARY FOR 2016

The International Souris River Board was created by the International Joint Commission in April 2000 when it combined responsibilities previously assigned under two separate references for the Souris River. The previous references were the International Souris River Board of Control Reference (1959) and the Souris-Red Rivers Engineering Board Reference (1948).

On June 9, 2005, the Board's mandate was further revised through an exchange of diplomatic notes, assigning water quality functions and the oversight for flood forecasting and operations to the Board. The consolidation of water quantity, water quality, and the oversight for flood forecasting and operations is a step in the evolution of the Board as it moves towards an integrated approach to transboundary water issues in the Souris River basin.

The Board determined that a workplan would be beneficial in helping the Board identify resource requirements and deliver on results. The Board agreed that the workplan should include costs related to normal Board activities such as meetings, the annual report, and special projects.

The workplan follows the four strategic initiatives of the International Watershed Initiative.

- Build shared understanding of the watershed and related transboundary issues.
- Communicate watershed issues at the local, regional and national levels to increase awareness, highlight potential issues, and identify opportunities for cooperation and resolution.
- Contribute to the resolution of watershed issues.
- Administer the existing orders and references.

Figure 1

MONTH END CONTENTS OF RESERVOIRS IN CANADA FOR THE YEARS 2014 AND 2015

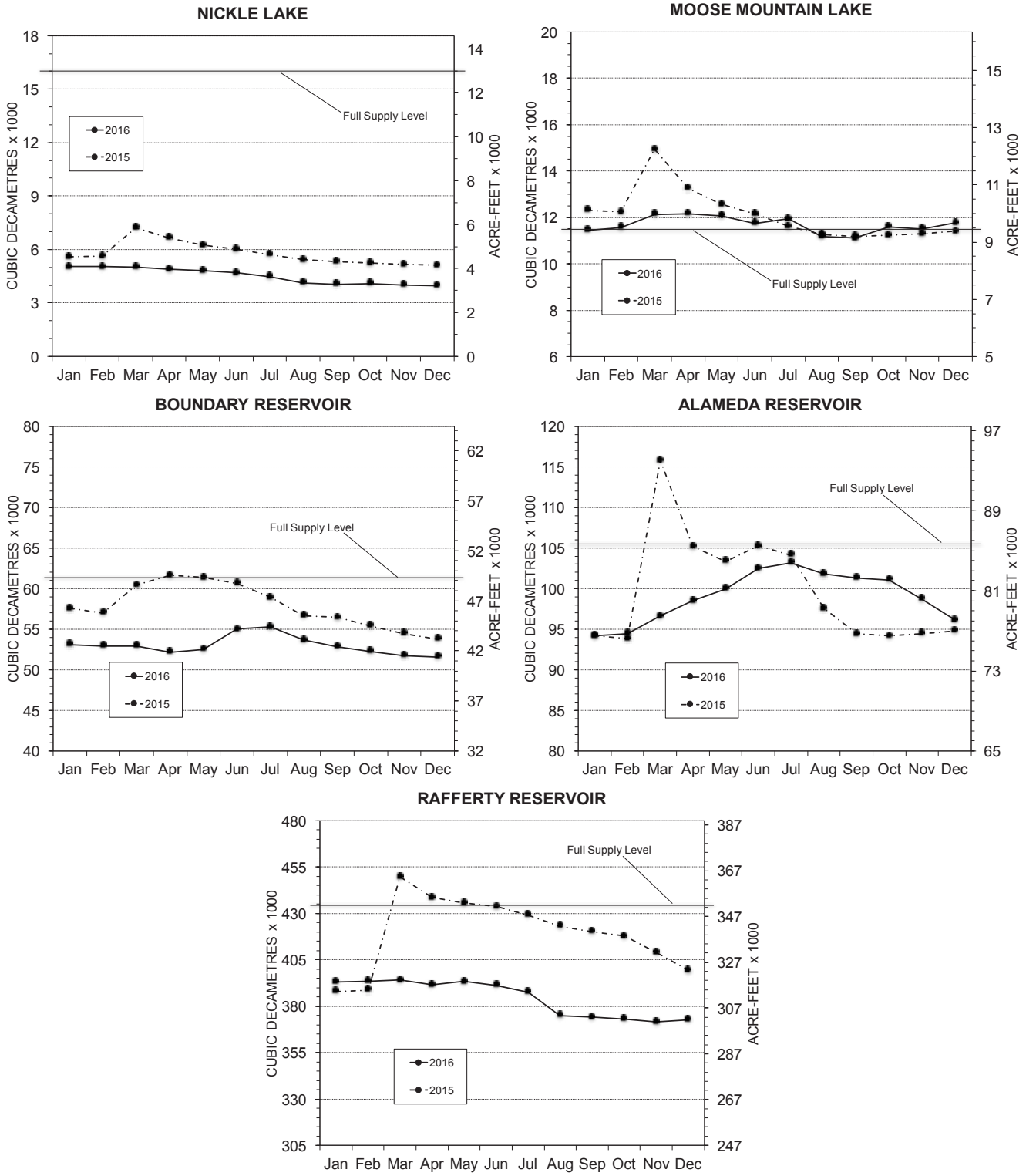


Figure 2

SCHEMATIC REPRESENTATION OF 2016 FLOWS IN THE SOURIS RIVER BASIN ABOVE SHERWOOD, NORTH DAKOTA, U.S.A.

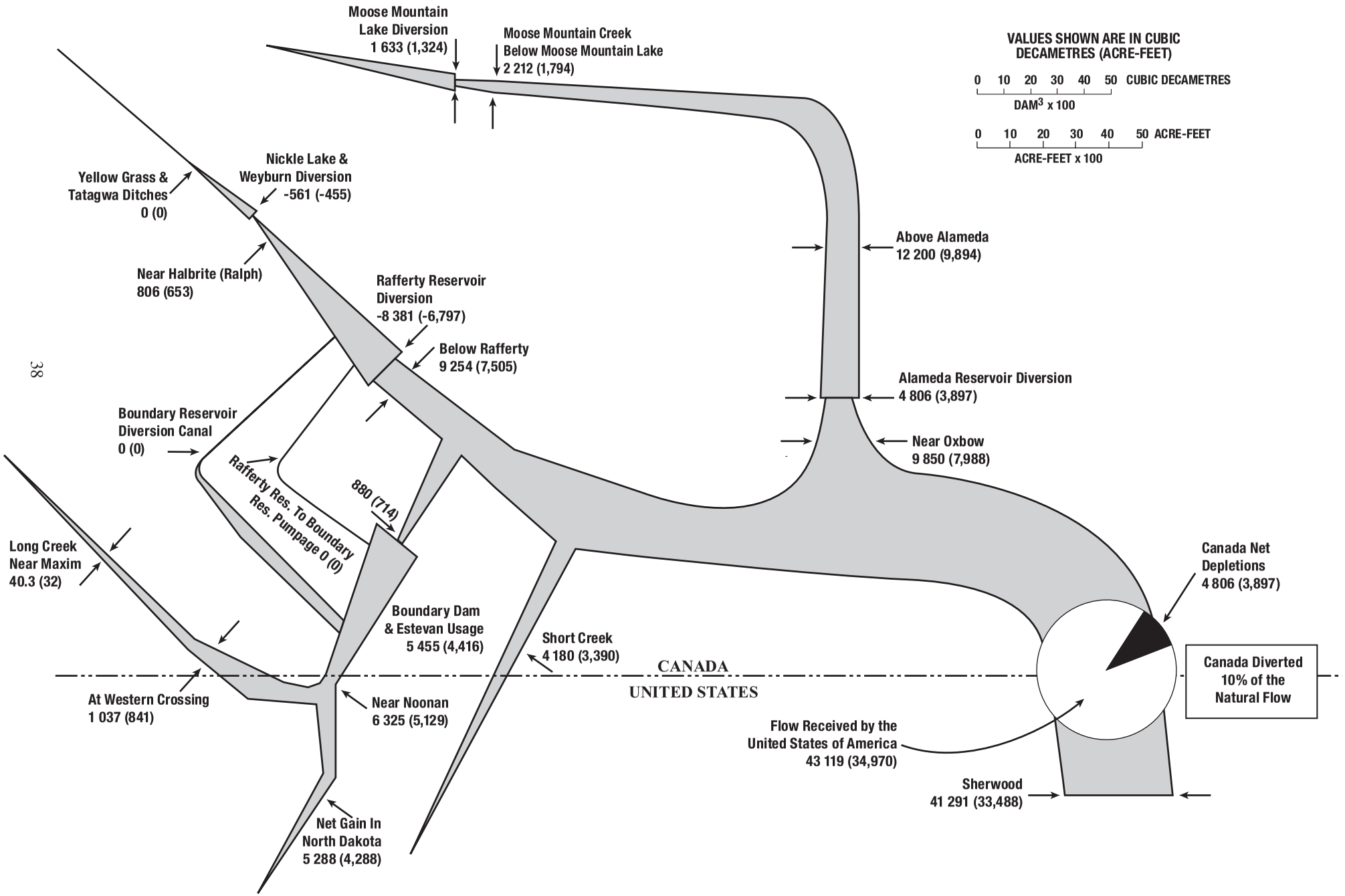


Figure 3

MONTH END CONTENTS OF RESERVOIRS IN USA FOR THE YEARS 2014 AND 2015

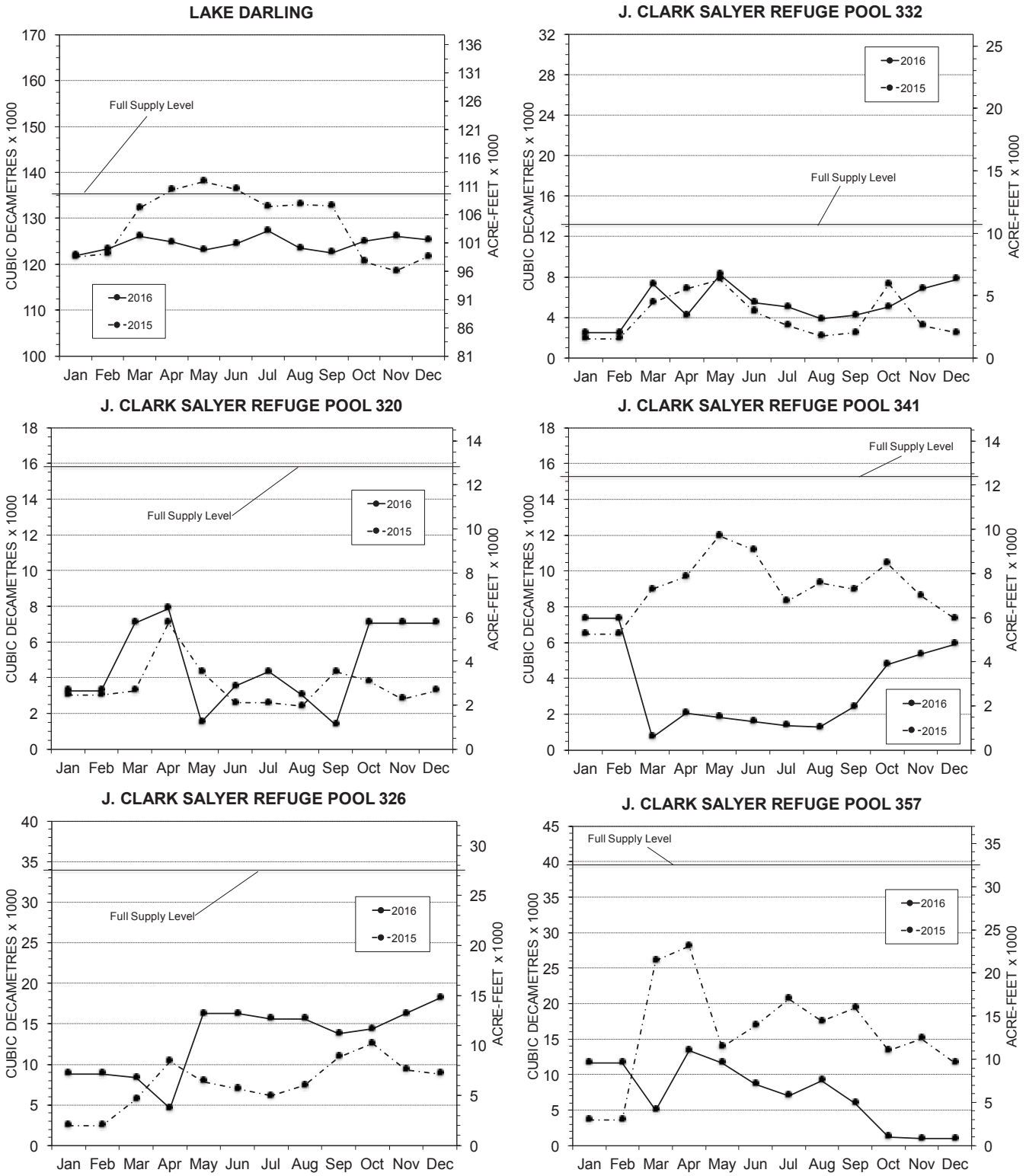
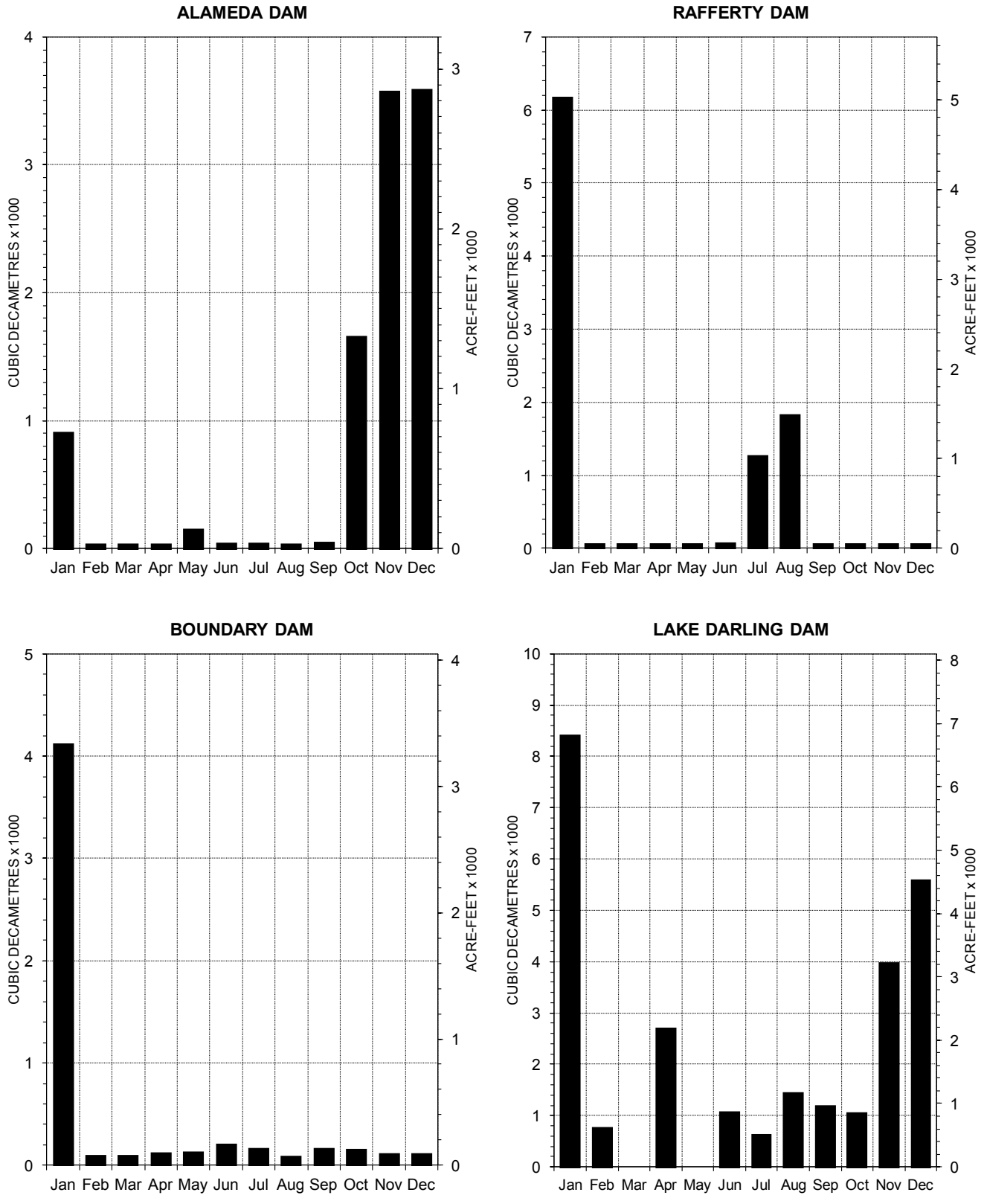


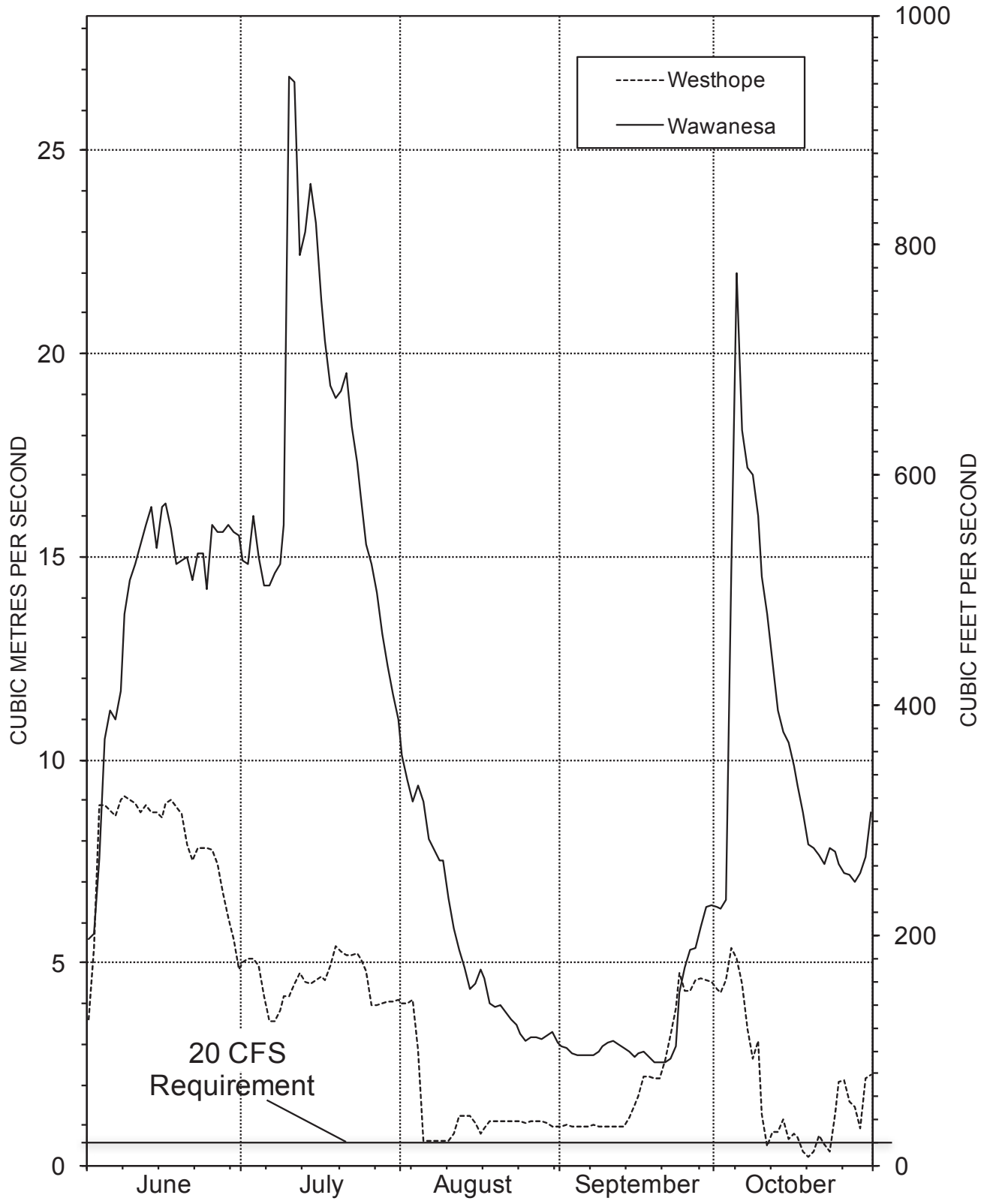
Figure 4

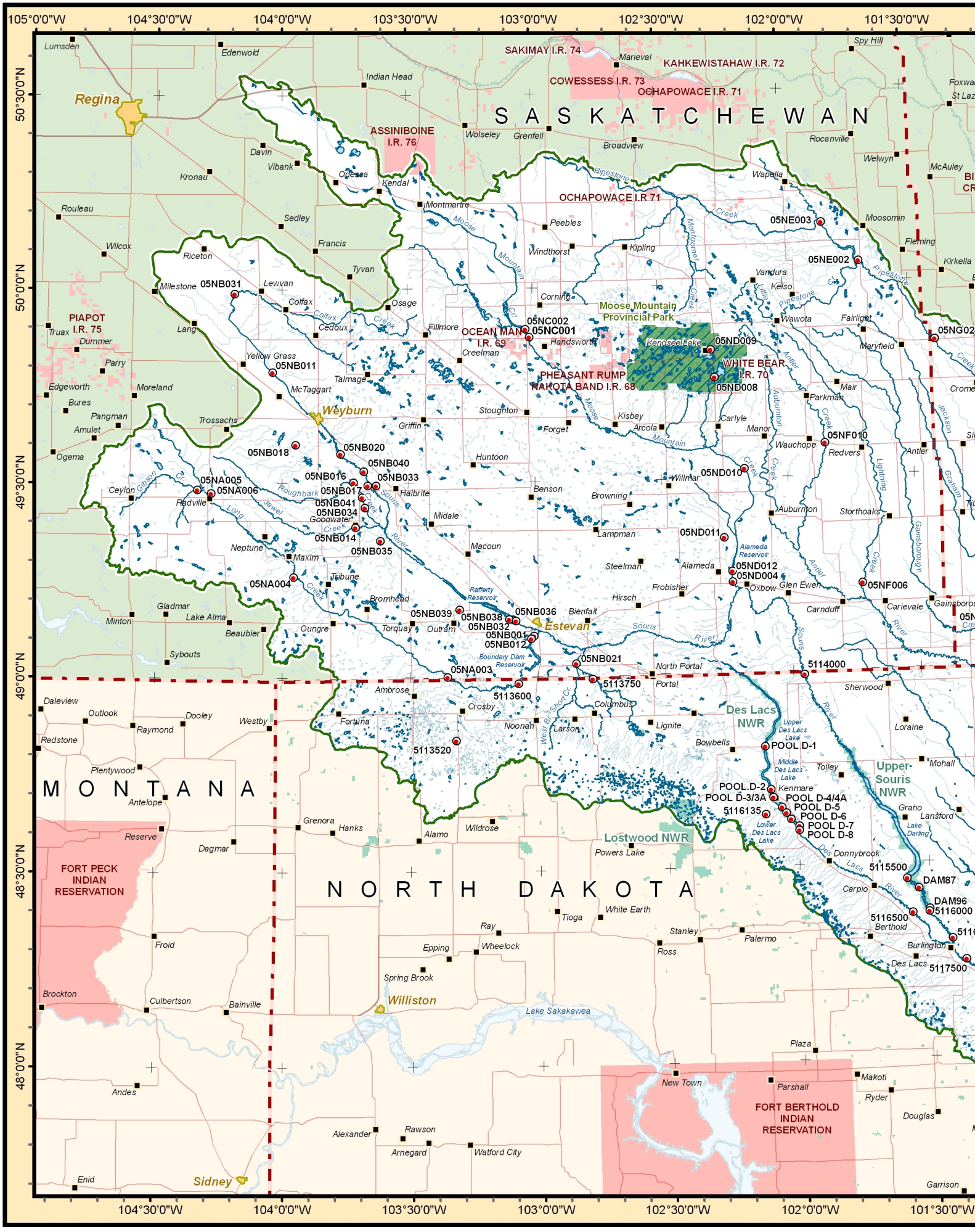
MONTHLY RESERVOIR RELEASES FOR THE YEAR 2016



SOURIS RIVER NEAR WESTHOPE
AND
SOURIS RIVER NEAR WAWANESA

June 1, 2016 to October 31, 2016

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MONTANA
NORTH DAKOTA
Regina
Weyburn
Estevan
Williston
Sidney
SAKIMAY I.R. 74
KAHKEWISTAHAW I.R. 72
COWESSESS I.R. 73
OCHAPOWACE I.R. 71
ASSINIBOINE I.R. 76
PIAPOT I.R. 75
OCEAN MAN I.R. 69
PHEASANT RUMP NAKOTA BAND I.R. 68
WHITE BEAR I.R. 70
FORT PECK INDIAN RESERVATION
FORT BERTHOLD INDIAN RESERVATION
Moose Mountain Provincial Park
Kenosee Lake
Des Lacs NWR
Upper Souris NWR
Lostwood NWR
Lake Sakakawea
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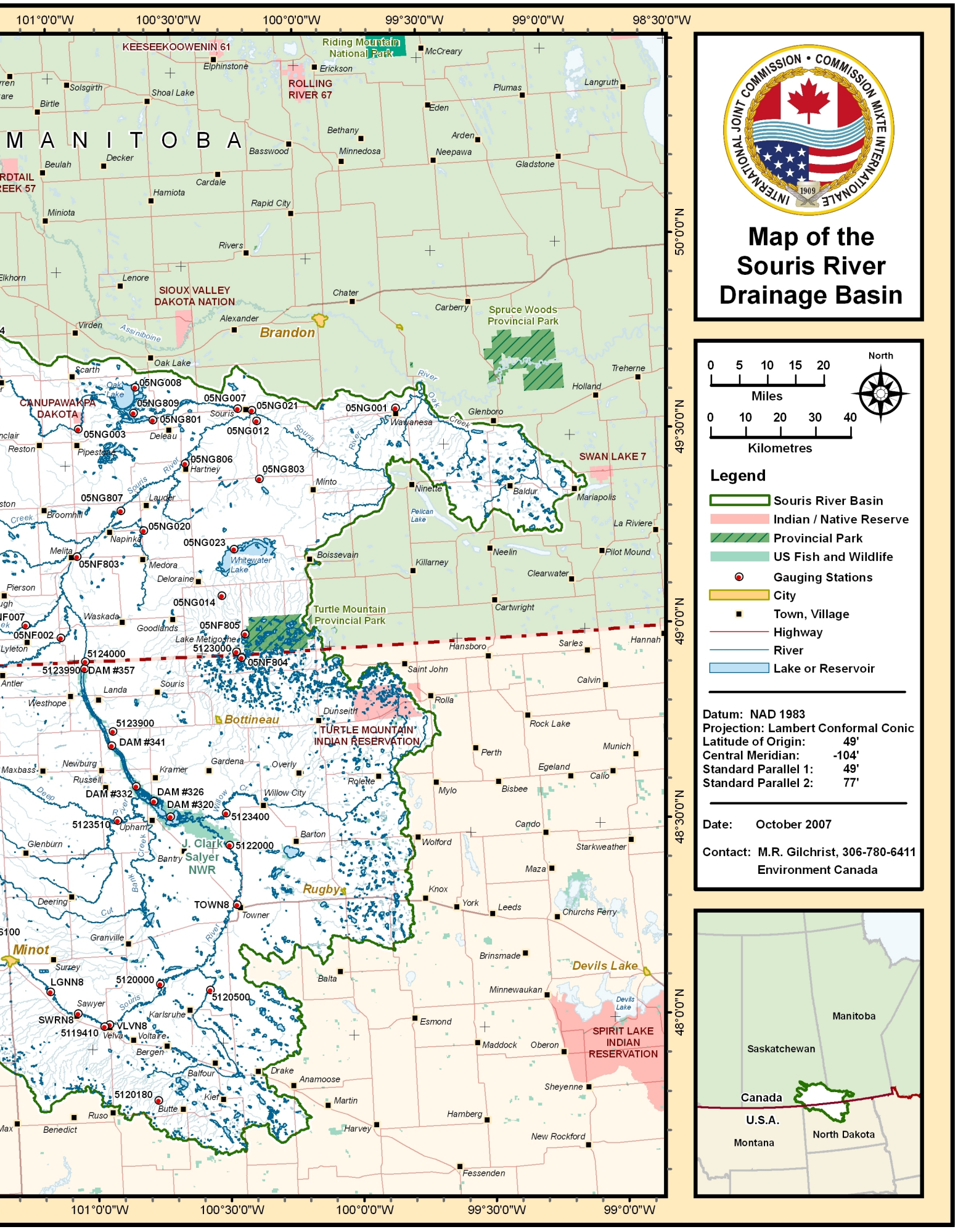
DAM96
Regina
Edenwold
Lumsden
Indian Head
Marieval
Spy Hill
Wolseley
Grenfell
Broadview
Rocanville
Welwyn
McAuley
Wapella
Davin
Vibank
Odessa
Kendal
Kronau
Montmartre
Rouleau
Sedley
Peebles
Windthorst
Kipling
Moosomin
Fleming
Kirkella
Wilcox
Riceton
Francis
Tyvan
Milestone
Lewvan
Colfax
Osage
Corning
Vandura
Kelso
Wawota
Fairlight
Truax
Lang
Cedoux
Fillmore
Handsworth
Creelman
Maryfield
Dummer
Parry
Yellow Grass
Talmage
McTaggart
Edgeworth
Moreland
Bures
Pangman
Amulet
Trossachs
Griffin
Stoughton
Forget
Kisbey
Arcola
Carlyle
Manor
Parkman
Mair
Wauchope
Redvers
Antler
Ogema
Huntoon
Willmar
Ceylon
Radville
Halbrite
Benson
Browning
Auburnton
Storthoaks
Midale
Lampman
Macoun
Neptune
Maxim
Steelman
Alameda
Glen Ewen
Oxbow
Tribune
Frobisher
Hirsch
Carnduff
Carievale
Gladmar
Lake Alma
Minton
Bromhead
Rafferty Reservoir
Alameda Reservoir
Beaubier
Oungre
Torquay
Outram
Bienfait
Souris River
Sybouts
Boundary Dam Reservoir
North Portal
Portal
Sherwood
Daleview
Outlook
Dooley
Raymond
Westby
Redstone
Ambrose
Crosby
Fortuna
Columbus
Noonan
Larson
Lignite
Bowbells
Loraine
Plentywood
Antelope
Tolley
Mohall
Kenmare
Grano
Lansford
Reserve
Grenora
Hanks
Alamo
Wildrose
Dagmar
Powers Lake
Donnybrook
Froid
Ray
Tioga
White Earth
Stanley
Palermo
Carpio
Berthold
Burlington
Epping
Wheelock
Ross
Spring Brook
Brockton
Culbertson
Bainville
Andes
Plaza
New Town
Parshall
Makoti
Ryder
Douglas
Alexander
Rawson
Arnegard
Watford City
Enid
Garrison



Map of the Souris River Drainage Basin

Datum: NAD 1983
Projection: Lambert Conformal Conic
Latitude of Origin: 49'
Central Meridian: -104'
Standard Parallel 1: 49'
Standard Parallel 2: 77'

Date: October 2007

Contact: M.R. Gilchrist, 306-780-6411
Environment Canada

APPENDIX A

Determination of Natural Flow of Souris River at International Boundary (Sherwood)

DETERMINATION OF NATURAL FLOW OF SOURIS RIVER AT INTERNATIONAL BOUNDARY (SHERWOOD)

All Quantities Reported In Cubic Decametres

FOR THE PERIOD: JANUARY 1 TO DECEMBER 31, 2016

LONG CREEK BASIN

LARSEN RESERVOIR				BOUNDARY RESERVOIR								
				INFLOW	OUTFLOW							
1	2	3	4	5 *	6	7	8	9	10	11	12 *	13
STORAGE CHANGE	EVAPORATION	DIVERSION	TOWN OF RADVILLE PUMPAGE	LONG CREEK AT EASTERN CROSSING	LONG CREEK NEAR ESTEVAN	ESTEVAN PIPELINE	DIVERSION CANAL	TOTAL (OUTFLOW)	DIVERSION	MINOR PROJECT DIVERSION	U.S.A. DIVERSION BETWEEN WESTERN & EASTERN CROSSING	**TOTAL DIVERSION LONG CREEK**
-84	120	36 (1+2)	30	6325 0 PIPELINE	521	1987	0	2508 (6+7+8)	3817 (5-9)	48	403	4334 **(3+4+10+11+12)**

UPPER SOURIS RIVER BASIN - ABOVE ESTEVAN

NICKLE LAKE RESERVOIR					ROUGHBARK RESERVOIR			RAFFERTY RESERVOIR				
14	15	16	17	18	19	20	21	22	23	24	25	26
STORAGE CHANGE	EVAPORATION	CITY OF WEYBURN PUMPAGE	DIVERSION	CITY OF WEYBURN RETURN FLOW	STORAGE CHANGE	EVAPORATION	DIVERSION	INFLOW	OUTFLOW 9254	DIVERSION	MINOR PROJECT DIVERSION	**TOTAL DIVERSION UPPER SOURIS RIVER**
-2500	1833	1368	701 (14+15+16)	1262	-192	192	0 (19+20)	873	0 PIPELINE	-8381 (22-23)	0	-8942 **(17-18+21+24+25)**

LOWER SOURIS RIVER--ESTEVAN TO SHERWOOD

27	28 *	29	30
CITY OF ESTEVAN NET PUMPAGE	SHORT CREEK DIVERSIONS IN U.S.A.	MINOR PROJECT DIVERSION	**TOTAL DIVERSION LOWER SOURIS RIVER**
1628	1425	300	3353 **(27+28+29)**

MOOSE MOUNTAIN CREEK BASIN

MOOSE MOUNTAIN LAKE			ALAMEDA RESERVOIR				
31	32	33	34	35	36	37	38
STORAGE CHANGE	EVAPORATION	DIVERSION	STORAGE CHANGE	EVAPORATION	DIVERSION	MINOR PROJECT DIVERSIONS	**TOTAL DIVERSIONS MOOSE MOUNTAIN CREEK BASIN**
400	1233	1633 (31+32)	1400	3406	4806 (34+35)	1450	7889 **(33+36+37)**

NON-CONTRIBUTORY BASINS

39	40	41
YELLOW GRASS DITCH	TATAGWA LAKE DRAIN	**TOTAL ADDITIONS**
0	0	0 (39+40)

SUMMARY OF NATURAL FLOW

42	43 *	44	45	46	47
TOTAL DIVERSION SOURIS RIVER BASIN	RECORDED FLOW AT SHERWOOD	NATURAL FLOW AT SHERWOOD	U..S.A. SHARE	FLOW RECEIVED BY U.S.A.	**SURPLUS (+) OR DEFICIT (-) TO U.S.A.**
			40% OF 44		(46-45) 40% SHARE
6634 (13+26+30+38)	41291	47925 (42+43-41)	50% OF 44 23960	43119 (12+28+43)	(46-45) 50% SHARE 19159

RECOMMENDATION - SECTION 2
ANNUAL FLOW OF LONG CREEK

48	49 *	50
RECORDED FLOW AT WESTERN CROSSING	RECORDED FLOW AT EASTERN CROSSING	**SURPLUS (+) OR DEFICIT (-) FROM U.S.A.**
1037	6325	**5288** (49-48)

*** DATA CONTRIBUTED BY U.S.G.S.**

APPENDIX B

Equivalents of Measurements

EQUIVALENTS OF MEASUREMENTS

The following is a list of equivalents of measurement that have been agreed to for use in reports of the International Souris River Board.

1 centimetre equals 0.39370 inch
1 metre equals 3.2808 feet
1 kilometre equals 0.62137 mile

1 hectare equals 10 000 square metres
1 hectare equals 2.4710 acres
1 square kilometre equals 0.38610 square mile

1 cubic metre per second equals 35.315 cubic feet per second

The metric (SI) unit that replaces the British acre-foot unit is the cubic decametre (dam^3), which is the volume contained in a cube 10 m x 10 m x 10 m or 1 000 cubic metres.

1 cubic decametre equals 0.81070 acre-feet
1 cubic metre per second flowing for 1 day equals 86.4 cubic decametres
1 cubic foot per second flowing for 1 day equals 1.9835 acre-feet

APPENDIX C

Interim Measures as Modified in 2000

INTERIM MEASURES AS MODIFIED IN 2000

APPENDIX A TO THE DIRECTIVE TO THE INTERNATIONAL SOURIS RIVER BOARD

1. The Province of Saskatchewan shall have the right to divert, store, and use waters which originate in the Saskatchewan portion of the Souris River basin, provided that such diversion, storage, and use shall not diminish the annual flow of the river at the Sherwood Crossing more than 50 percent of that which would have occurred in a state of nature, as calculated by the International Souris River Board. For the purpose of these calculations, any reference to "annual" and "year" is intended to mean the period January 1 through December 31.

   For the benefit of riparian users of water between the Sherwood Crossing and the upstream end of Lake Darling, the Province of Saskatchewan shall, so far as is practicable, regulate its diversions, storage, and uses in such a manner that the flow in the Souris River channel at the Sherwood Crossing shall not be less than 0.113 cubic metre per second (4 cubic feet per second) when that much flow would have occurred under the conditions of water use development prevailing in the Saskatchewan portion of the Souris River basin prior to construction of the Boundary Dam, Rafferty Dam, and Alameda Dam.

   Under certain conditions, a portion of the North Dakota share will be in the form of evaporation from Rafferty and Alameda Reservoirs. During years when these conditions occur, the minimum amount of flow actually passed to North Dakota will be 40 percent of the annual natural flow volume at the Sherwood Crossing. This lesser amount is in recognition of Saskatchewan's operation of Rafferty Dam and Alameda Dam for flood control in North Dakota and of evaporation as a result of the project.

   a. Saskatchewan will deliver a minimum of 50 percent of the annual natural flow volume at the Sherwood Crossing in every year except in those years when the conditions given in (i) or (ii) below apply. In those years, Saskatchewan will deliver a minimum of 40 percent of the annual natural flow volume at the Sherwood Crossing.

      i. The annual natural flow volume at Sherwood Crossing is greater than 50 000 cubic decametres (40,500 acre-feet) and the current year June 1 elevation of Lake Darling is greater than 486.095 metres (1594.8 feet); or

      ii. The annual natural flow volume at Sherwood Crossing is greater than 50 000 cubic decametres (40,500 acre-feet) and the current year June 1 elevation of Lake Darling is greater than 485.79 metres (1593.8 feet), and since the last occurrence of a Lake Darling June 1 elevation of greater than 486.095 metres (1594.8 feet) the elevation of Lake Darling has not been less than 485.79 metres (1593.8 feet) on June 1.

   b. Notwithstanding the annual division of flows that is described in (a), in each year Saskatchewan will, so far as is practicable as determined by the Board, deliver to North Dakota prior to June 1, 50 percent of the first 50 000 cubic decametres (40,500 acre-feet) of natural flow which occurs during the period January 1 to May 31. The intent of this division of flow is to ensure that North Dakota receives 50 percent of the rate and volume of flow that would have occurred in a state of

nature to try to meet existing senior water rights.

c. Lake Darling Reservoir and the Canadian reservoirs will be operated (insofar as is compatible with the Projects' purposes and consistent with past practices) to ensure that the pool elevations, which determine conditions for sharing evaporation losses, are not artificially altered. The triggering elevation of 485.79 metres (1593.8 feet) for Lake Darling Reservoir is based on existing water uses in North Dakota, including refuges operated by the U.S. Fish and Wildlife Service. Each year, operating plans for the refuges on the Souris River will be presented to the Board. Barring unforeseen circumstances, operations will follow said plans during each given year. Lake Darling Reservoir will not be drawn down for the sole purpose of reaching the elevation of 485.79 metres (1593.8 feet) on June 1.

   Releases will not be made by Saskatchewan Watershed Authority from the Canadian reservoirs for the sole purpose of raising the elevation of Lake Darling Reservoir above 486.095 metres (1594.8 feet) on June 1.

d. Flow releases to the United States should occur (except in flood years) in the pattern which would have occurred in a state of nature. To the extent possible and in consideration of potential channel losses and operating efficiencies, releases from the Canadian dams will be scheduled to coincide with periods of beneficial use in North Dakota. Normally, the period of beneficial use in North Dakota coincides with the timing of the natural hydrograph, and that timing should be a guide to releases of the United States portion of the natural flow.

e. A determination of the annual apportionment balance shall be made by the Board on or about October 1 of each year. Any shortfall that exists as of that date shall be delivered by Saskatchewan prior to December 31.

f. The flow release to the United States may be delayed when the State of North Dakota determines and notifies Saskatchewan through the Board that the release would not be of benefit to the State at that time. The delayed release may be retained for use in Saskatchewan, notwithstanding the 0.113 cubic metre per second (4 cubic feet per second) minimum flow limit, unless it is called for by the State of North Dakota through the Board before October 1 of each year. The delayed release shall be measured at the point of release and the delivery at Sherwood Crossing shall not be less than the delayed release minus the conveyance losses that would have occurred under natural conditions between the point of release and the Sherwood Crossing. Prior to these releases being made, consultations shall occur between the Saskatchewan Watershed Authority, the U.S. Fish and Wildlife Service, and the State of North Dakota. All releases will be within the specified target flows at the control points.

2. Except as otherwise provided herein with respect to delivery of water to the Province of Manitoba, the State of North Dakota shall have the right to divert, store, and use the waters which originate in the North Dakota portion of the Souris River basin together with the waters delivered to the State of North Dakota at the Sherwood Crossing under Recommendation (1) above; provided, that any diversion, use, or storage of Long Creek water shall not diminish the annual flow at the eastern crossing of Long Creek into Saskatchewan below the annual flow of said Creek at the western crossing into North Dakota.

3. (a) In addition to the waters of the Souris River basin which originate in the Province of Manitoba, that Province shall have the right, except during periods of severe drought, to receive for its own use and the State of North Dakota shall deliver from any available source during the months of June, July, August, September, and October of each year, six thousand and sixty-nine (6,069) acre-feet of water at the Westhope Crossing regulated so far as practicable at the rate of twenty (20) cubic feet per second except as set forth hereinafter: provided, that in delivering such water to Manitoba no account shall be taken of water crossing the boundary at a rate in excess of the said 20 cubic feet per second.

   (b) In periods of severe drought when it becomes impracticable for the State of North Dakota to provide the foregoing regulated flows, the responsibility of the State of North Dakota in this connection shall be limited to the provision of such flows as may be practicable, in the opinion of the said Board of Control, in accordance with the objective of making water available for human and livestock consumption and for household use. It is understood that in the circumstances contemplated in this paragraph the State of North Dakota will give the earliest possible advice to the International Souris River Board of Control with respect to the onset of severe drought conditions.

4. In event of disagreement between the two sections of the International Souris River Board of Control, the matters in controversy shall be referred to the Commission for decision.

5. The interim measures for which provision is herein made shall remain in effect until the adoption of permanent measures in accordance with the requirements of questions (1) and (2) of the Reference of January 15, 1940, unless before that time these interim measures are qualified or modified by the Commission.

APPENDIX D

Board Directive from January 18, 2007

DIRECTIVE TO THE INTERNATIONAL SOURIS RIVER BOARD

The International Souris River Board was created by the International Joint Commission in April 2000 when it amalgamated the Souris River basin responsibilities previously assigned to the Commission in two separate references by the governments of Canada and the United States. The two references were the International Souris River Board of Control Reference (1959) and the Souris-Red Rivers Engineering Board Reference (1948). The International Souris River Board's mandate changed further through an exchange of diplomatic notes on June 9, 2005 assigning water quality functions and the oversight for flood forecasting and operations as described in Section 4 below. The consolidation of water quantity, water quality, and the oversight for flood forecasting and operations is a step in the evolution of the International Souris River Board as it moves towards an integrated approach to transboundary water issues in the Souris River basin.

This directive replaces the April 11, 2002 Directive to the International Souris River Board and sets out the mandate under which the Board will operate.

1. Pursuant to the Boundary Waters Treaty of 1909 and related agreements, responsibilities have been conferred on the Commission to ensure compliance with apportionment measures for the waters of the Souris River, to investigate and report on water requirements and uses as they impact the transboundary waters of the Souris River basin, and to assist in the implementation and review of the Joint Water Quality Monitoring Program pursuant to the 1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River Basin.

2. The apportionment measures derive from the approvals given by the governments of Canada and the United States, by letters of March 20, 1959 and April 3, 1959 respectively, to the recommendations made by the Commission in paragraph 22 of its report to the governments of March 19, 1958. Subsequently, with the signing of the Canada-United States Agreement for Water Supply and Flood Control in the Souris River basin on October 26, 1989 (hereafter referred to as the 1989 Agreement), the Interim Measures for apportionment of the Souris River at the Saskatchewan-North Dakota boundary were revised as described in Annex B of the 1989 Agreement. By letters of February 28, 1992, the Commission was requested to monitor compliance with the measures as modified in the 1989 Agreement. By letters of December 20 and 22, 2000, the governments amended Annex B of the 1989 Agreement. The attached Appendix A is a consolidation of the apportionment measures against which the Commission is to monitor compliance.

3. By letters of January 12, 1948, the governments requested the Commission to undertake investigations of water requirements and uses arising out of existing dams and other works or projects in the mid-continent portion of the Canada-United States boundary, including the Souris River basin, and to make advisory recommendations.

4. By exchange of diplomatic notes between the governments of Canada and the United States dated January 14 and June 9, 2005, the 1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River Basin was formally revised to include a reference pursuant to Article IX of the Boundary Waters Treaty which assigned water quality responsibilities contained in the 1989 Agreement to the Commission. The Commission was requested to assist with the implementation and review of the Joint Water Quality Monitoring Program. On October 21, 2005 at the October 2005 Commission's meeting with governments, the U.S. State Department read a statement into the Commission's formal record that the U.S. State Department is of the opinion the Commission has the authority and has obtained the notification it needs from the U.S. State Department to proceed with carrying out the flood related responsibilities for the Souris River. On April 6, 2006 at the April 2006 Commission's meeting with governments, the Department of Foreign Affairs and International Trade indicated that the Board should be assigned these responsibilities. It is recognized that Article X of the 1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River basin designates the entities responsible for operation and maintenance of the improvements mentioned in the 1989 Agreement and that the operations will be in accordance with the Operating Plan shown in Annex A of the 1989 Agreement. The Department of Army is the entity designated responsible for flood operations within the United States. The Government of Saskatchewan is the Canadian entity designated responsible for flood operations within the Canadian Province of Saskatchewan.

5. The Board's mandate is to support the Commission's initiative to explore and encourage the development of local and regional capacity with the objective of preventing and resolving transboundary disputes regarding the waters and aquatic ecosystem of the Souris River and its tributaries and aquifers. This would be accomplished through the application of best available science and knowledge of the aquatic ecosystem of the basin and an awareness of the needs, expectations and capabilities of residents of the Souris River basin. The Board's mandate will be accomplished by performing the tasks identified in Clause 6 below.

6. The Board's duties shall be to:

   (i) Maintain an awareness of existing and proposed developments, activities, conditions, and issues in the Souris River basin that may have an impact on transboundary water levels, flows, water quality, and aquatic ecosystem health and inform the Commission about existing or potential transboundary issues.

   (ii) Oversee the implementation of compliance with the Interim Measures As Modified For Apportionment of the Souris River as described in Appendix A of this document by:
   - identifying an adequate hydro-climatic monitoring network to support the determination of natural flow and apportionment balance,
   - encouraging the appropriate authorities to establish and maintain hydro-climatic monitoring and information collection networks and reporting

systems to ensure suitable information is available as required for the determination of natural flow and apportionment balance,

- informing the Commission, in a timely manner, of critical water supply or flow conditions in the basin,
- encouraging appropriate authorities to take steps to ensure that apportionment measures are met, and
- preparing an annual report and submitting it to the Commission.

(iii) Assist the Commission in the review of a Joint Water Quality Monitoring Program (referred to hereafter as "the Program") by:

- developing recommendations on the Program and the setting of water quality objectives,
- exchanging data provided by the Program on a regular basis,
- collating, interpreting, and analyzing the data provided by the Program,
- reviewing the Program and the water quality objectives at least every five years and developing recommendations, as appropriate, to the Commission to improve the Program and the objectives, and
- preparing an annual report containing:
  - a summary of the principal activities of the Board during the year with respect to the Program,
  - a summary of the principal activities affecting water quality in the Souris River Basin during the year,
  - a summary of the collated, interpreted, and analyzed data provided by the Program,
  - a summary of the water quality of the Souris River at the two locations at which it crosses the International Boundary,
  - a section summarizing any definitive changes in the monitored parameters and the possible causes of such changes,
  - a section discussing the water quality objectives for the Souris River at the Saskatchewan/North Dakota boundary and at the North Dakota/Manitoba boundary as established and revised pursuant to the 1989 Agreement,
  - a section summarizing other significant water quality changes and the possible causes of such changes, and
  - recommendations on new water quality objectives or on how existing water quality objectives can be met, including suggestions on water quality as it relates to water quantity during periods of low flow, in the event that the annual report indicates that the water quality objectives have not been attained as a result of activities pursued under the 1989 Agreement.

(iv) Perform an oversight function for flood operations in cooperation with the designated entities identified in the 1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River Basin by:

- ensuring mechanisms are in place for coordination of data exchange, flood forecasts and communications related to flood conditions and operations;
- determining whether the operations under the 1989 Agreement should proceed based on the Flood Operation or Non-Flood Operation of the Operating Plan, which is Annex A to the 1989 Agreement, using its criteria and informing designated agencies of this determination;
- reporting to the Commission on any issues related to flood operations and management; and
- providing the Commission and the designated entities under the 1989 Agreement recommendations on how flood operations and coordination activities could be improved.

(v) Report on aquatic ecosystem health issues in the watershed, regularly informing the Commission on the state and implications of aquatic ecosystem health, and encourage the appropriative authorities to establish and maintain water quality and other monitoring and information collection networks and reporting systems to ensure suitable information is available as required for the determination of the health of the aquatic ecosystem.

(vi) Carry out such other studies or activities as the Commission may, from time to time, request.

(vii) Prepare an annual work plan including both routine board activities and new initiatives planned to be conducted in the subsequent year. The work plan shall be submitted annually to IJC for review.

7. The Board shall provide opportunities for the public to be involved in its work, including at least one public meeting in the basin each year.

8. The Board shall coordinate and collaborate with other agencies and institutions both within and outside the Souris River basin as may be needed or desirable, and facilitate the timely dissemination of pertinent information within the basin. The Board shall keep the Commission informed of these activities.

9. The Board shall have an equal number of members from each country. The Commission shall normally appoint each member for a three-year term. Appointments may be renewed for additional terms. Members shall act in their personal and professional capacity, and not as representatives of their countries, agencies or institutions. The Commission shall appoint Canadian and United States co-chairs of the Board and will strive to appoint chairs with complementary expertise that encompasses a broad spectrum of basin issues.

10. The co-chairs of the Board shall be responsible for maintaining proper liaison between the Board and the Commission, and among the Board members.

11. The co-chairs shall ensure that members of the Board are informed of all instructions, inquiries, and authorizations received from the Commission and also of activities undertaken by or on behalf of the Board, progress made, and any developments affecting such progress.

12. The co-chairs may appoint secretaries of the Board who, under the general supervision of the co-chairs, shall carry out such duties as are assigned by the co-chairs or the Board as a whole.

13. The Board may establish such committees and working groups as may be required to fulfill its responsibilities in a knowledgeable and effective manner. The Commission shall be kept informed of the duties and composition of any committee or working group.

14. Unless other arrangements are made with the Commission, members of the Board, committees, or working groups shall make their own arrangements for reimbursement of necessary expenditures for travel or other related expenses.

15. The Board shall inform the Commission in advance of plans for any meetings, or other means of involving the public in Board deliberations, and shall report to the Commission, in a timely manner, on these and any other presentations or representations made to the Board.

16. The Board shall conduct its public outreach activities in accordance with the Commission's public information policies and shall maintain files in accordance with the Commission policy on segregation of documents.

17. Prior to their release, the Board shall provide the text of media releases and other public information materials to the Secretaries of the Commission for review by the Commission's Public Information Officers.

18. The Board shall submit an annual report covering all of its activities, including the annual report regarding the Program and the work plan, as described in Section 6 above, to the Commission, at least three weeks in advance of the Commission's fall semi-annual meeting, and the Board shall submit other reports as the Commission may request or the Board may feel appropriate in keeping with this Directive. Reports shall be submitted in a format suitable for public release and electronic copies shall be provided to each of the Commission's section offices.

19. Reports, including annual reports, minutes and correspondence of the Board shall, normally, remain privileged and be available only to the Commission and to members of the Board and its committees until their release has been authorized by the Commission. The Board shall provide minutes of Board meetings to the Commission within 45 days of the close of the meeting in keeping with the Commission's April 2002 Policy Concerning Public Access to Minutes of Meetings. The minutes will subsequently be put on the Commission's web site.

20. If, in the opinion of the Board or of any member, any instruction, directive, or authorization received from the Commission lacks clarity or precision, the matter shall be referred promptly to the Commission for appropriate action.

21. The Board shall operate by consensus. In the event of any disagreement among the members of the Board which they are unable to resolve, the Board shall refer the matter forthwith to the Commission for decision.

22. The Commission may amend existing instructions or issue new instructions to the Board at any time.

Signed this 18th day of January, 2007

Elizabeth Bourget
Secretary
United States Section

Murray Clamen
Secretary
Canadian Section

APPENDIX E

Water Quality Data for Sherwood and Westhope

ANNUAL WATER QUALITY OBJECTIVES SUMMARY
SOURIS RIVER - NORTH DAKOTA/SASKATCHEWAN BOUNDARY 2016
05114000 SHERWOOD USGS

WATER QUALITY PARAMETERS	WATER QUALITY OBJECTIVE	UNITS	HISTORIC DATA* Median(max-min)#samples	ANNUAL DATA* Median(max-min)#samples	%EXCEEDANCE (2016)
Biological Parameters					
Fecal Coliform	200/100 ml	#/100 mL	30 (8,300-<1) 196	NDA	0
E. coli	**	#/100mL	NDA	200(310-120)4	**
Inorganic Parameters					
Ammonia (un-ionized as N)	****	mg/L	0.001 (0.025-<0.001) 222	NDA	0
Chloride	100	mg/L	42 (220-4) 355	40.75 (69.4 – 16.5) 8	0
Fluoride	1.5	mg/L	0.2 (1.8-<0.1) 355	0.185 (0.23 – 0.15) 8	0
NO_2 + NO_3(as N) dissolved	1.0	mg/L	0.1 (1.4-<0.01) 324	0.04 (0.295 – 0.04) 8	0
Phosphorus (total P)	0.10	mg/L	0.19 (1.9-0.02) 401	0.175 (0.37 – 0.06) 8	63
Sodium	100	mg/L	120 (532-14) 361	146.5 (236 – 72) 8	75
Sulfate	450	mg/L	240 (1,000-45) 363	297 (505 – 219) 8	13
Arsenic (total)	50	µg/L	<4.0 (28.3-<0.1) 197	4.8 (12.1 – 2.3) 8	0
Barium (total)	1,000	µg/L	<100 (300-14.7)196	79.2 (116 – 61.6) 8	0
Boron (total)	500	µg/L	187 (3,500-40) 194	149 (284 – 84) 8	0
Beryllium (total)	100	µg/L	<10 (43.5-<0.02) 189	<0.02 (0.08 – <0.02) 8	0
Cadmium (total)	***27	µg/L	<1 (<2-<0.01) 189	<0.03 (0.111 – <0.03) 8	0
Chromium (total)	50	µg/L	<1(30-<0.3) 189	0.595 (2.3 – <0.4) 8	0
Cobalt(total)	50	µg/L	0.91 (2-0.25) 189	0.605 (1.7 – 0.41) 8	0
Copper(total)	***30	µg/L	2.5 (20-<0.8) 188	1.85 (4.6 – 1.5) 8	0
Iron (total)	300	µg/L	635 (10,000-60) 204	524 (2860 – 194) 8	75

* Values below detection limits (<) are calculated at ½ detection limit
**Objective not final
***based on hardness of 300 mg/L

NDA: No Data Available
NC: Not Calculated

ANNUAL WATER QUALITY OBJECTIVES SUMMARY
SOURIS RIVER - NORTH DAKOTA/SASKATCHEWAN BOUNDARY 2016
05114000 SHERWOOD USGS

WATER QUALITY PARAMETER	WATER QUALITY OBJECTIVE	UNITS	HISTORIC DATA* Median(max-min)#samples	ANNUAL DATA* Median(max-min)#samples	%EXCEEDANCE (2016)
Lead (total)	***13	µg/L	<1 (4.54 - 0.1) 192	0..29 (1.61 – 0.11) 8	0
Mercury	0.5 ug/g in fish flesh	µg/g	NDA	NDA	
Molybdenum (total)	10	µg/L	3.0 (45 - 0.48) 192	4.06 (5.36 – 3.44) 8	0
Nickel (total)	***220	µg/L	4 (17- <1) 210	3.8 (6.4 – 2.4) 8	0
Selenium (total)	5	µg/L	<1(14 - <0.211) 196	0.47 (0.600 – 0.305) 8	0
Zinc (total)	30	µg/L	10 (620 - <2) 237	3.25 (14 – <2) 8	0
Miscellaneous					
Total Dissolved Solids	1,000	mg/L	727 (2,310 - 159) 255	807 (1080 – 576) 8	13
Total Suspended Solids	the lesser of 10 mg/L or 10% over ambient	mg/L	17 (256 - <1) 232	15.75 (116 - <15) 8	**
pH (range)	8.5-6.5	standard units	8.1 (9.2-6.9) 478	8.3 (8.4 – 7.7) 8	0
Dissolved Oxygen (conc.)	>5.0	mg/L	8.2 (19.4-0.0) 464	9.8 (13 – 6.5) 8	0
Aesthetics		visual	NDA		NDA
Oil and Grease		visual	NDA		NDA

* Values below detection limits (<) are calculated at ½ detection limit
** Water Quality Objective now below detection limit
*** based on a hardness of 300 mg/L
NDA: No Data Available

ANNUAL WATER QUALITY OBJECTIVES SUMMARY
SOURIS RIVER - NORTH DAKOTA/SASKATCHEWAN BOUNDARY 2016
05114000 SHERWOOD USGS

WATER QUALITY PARAMETER	WATER QUALITY OBJECTIVE	UNITS	HISTORIC DATA** Median(max-min)#samples	ANNUAL DATA** Median(max-min)#samples	%EXCEEDANCE (2016)
Organic Parameters*					
Atrazine	2	µg/L	0.0034(0.0087-0.0022)20	0.0039(0.0076-00029)3	0
Bromoxynil	5	µg/L	(ND)15	(ND)5	0
Carbaryl	90	µg/L	(ND)24	(ND)6	0
Chlordane	0.0043	µg/L	NS	NS	
DDT	0.001	µg/L	NS	NS	
Dieldrin	0.0019	µg/L	NS	NS	
Dicamba	In development	µg/L	(ND)25	(ND)6	0
Diclofop-methyl	In development	µg/L	(ND)7	NS	
Heptachlor	0.0038	µg/L	NS	NS	
MCPA	0.20	µg/L	0.0047(0.024-0.0025)19	0.168(0.024-0.0097)6 (4ND)	0
Parathion	0.04	µg/L	(ND)25	(ND)6	0
Picloram	0.05	µg/L	24 ND/0.58	(0.58)5	0
Phenols(total)	1.0	µg/L	<17 (26 - <17) 225***	<50 (<50 – 10) 5****	NC
Polychlorinated biphenyl (total)	0.001	µg/L	NS	NS	
Triallate	0.57	µg/L	(ND)25	(ND)6	0
Trifluralin	0.10	µg/L	NS	NS	
2,4-D	4.0	µg/L	0.0105(0.043-0.0045)21	0.032(0.043-0.011)3	0

* Anomalies in historic data for pesticides resulted in the removal of data, except for last 4 years (2013-2016). Data will be corrected for the 2017 report.
** For Pesticides, values are for data above detection limits. For Phenols, values below detection limits (<) are calculated at ½ detection limit
*** Due to the difficulty involved in phenol analysis, the historic data was resensored to the highest detection limit that occurred during the period of record (<50). During this time detection limits have varied between <1 and <50. Values recorded above the method detection limit specific to each sample range from 1 to 60 during the period of record.
**** Annual phenol data was also resensored to the highest detection limit that occurred during 2016 (<50).
ND: Non-Detect/Below Detection Limit No Data Available
NS: Parameter was not sampled for
NC: Not calculated

ANNUAL WATER QUALITY OBJECTIVES SUMMARY
SOURIS RIVER - MANITOBA/NORTH DAKOTA BOUNDARY 2016
US05NF0001 WESTHOPE

WATER QUALITY PARAMETERS (1995-2016)	WATER QUALITY OBJECTIVE	UNITS	HISTORIC DATA* Median (max - min) #samples	ANNUAL DATA 2016 Median (max - min) #samples	%EXCEEDANCE (2016)
Biological Parameters					
Fecal Coliform	200/100 ml	#/100 ml	5 (1900 - <2) 171	6 (1900 - <2) 8	13
E. coli [a]	Objective not final	#/100 ml	4.5 (2800 - <2) 70	9 (1800 - <2) 8	
Inorganic Parameters					
Ammonia (un-ionized as N)	***	mg/L	0.004 (0.425 – 0.000) 164	0.011 (0.185 – 0.000) 8	
Chloride	100	mg/L	33.1 (297 - 6.2) 170	32.5 (39.1 - 13.9) 8	0
Fluoride	1.5	mg/L	0.19 (0.87 - <0.01) 169	0.15 (0.19 - 0.12) 8	0
NO_2 + NO_3 (as N) dissolved	1.0	mg/L	<0.01 (1.11 - <0.01) 169	0.01 (0.12 - <0.01) 8	0
Phosphorus (total P)	0.10	mg/L	0.30 (4.52 - 0.09) 168	0.19 (0.44 - 0.10) 8	100
Sodium	100	mg/L	154 (1040 - 19) 170	152 (187 - 112) 8	100
Sulfate	450	mg/L	313 (3490 - 38) 170	391 (451 - 231) 8	13
Arsenic (total)	50	µg/L	4.8 (33.4 - 0.6) 168	6.8 (14.2 - 3.0) 8	0
Barium (total)	1,000	µg/L	86.6 (631 - 32.3) 169	106 (301 - 69.3) 8	0
Boron (total)	500	µg/L	198 (2080 - <2) 155	212 (279 - 149) 8	0
Beryllium (total) [b]	100	µg/L	0.02 (0.12 - <0.001) 109	0.04 (0.12 - 0.01) 8	0
Cadmium (total) [b]	**27	µg/L	0.02 (0.12 - 0.006) 109	0.04 (0.08 - 0.02) 8	0
Chromium (total) [b]	50	µg/L	0.30 (2.36 - 0.07) 109	0.74 (2.35 - 0.33) 8	0
Cobalt (total) [b]	50	µg/L	0.50 (4.97 - 0.17) 109	1.02 (2.12 - 0.36) 8	0
Copper (total)	**30	µg/L	1.79 (21 - 0.32) 169	3.04 (4.56 - 1.81) 8	0
Iron (total)	300	µg/L	323 (14,500 - 14) 169	797 (3390 - 266) 8	88

* Values below detection limits (<) are calculated at ½ detection limit, dataset is from 1995 - 2016 unless otherwise indicated
[a] historic data calculated from 2008 – 2016
[b] historic data calculated from 2003 – 2016 due to analytical method changes
**based on hardness of 300 mg/L
***unionized ammonia is calculated using temperature and pH

ANNUAL WATER QUALITY OBJECTIVES SUMMARY
SOURIS RIVER - MANITOBA/NORTH DAKOTA BOUNDARY 2016
US05NF0001 WESTHOPE

WATER QUALITY PARAMETER	WATER QUALITY OBJECTIVE	UNITS	HISTORIC DATA* Median (max - min) #samples	ANNUAL DATA 2016 Median (max - min) #samples	%EXCEEDANCE (2016)
Lead (total) [b]	**13	µg/L	0.28 (5.17 - 0.03) 109	0.88 (4.06-0.30) 8	0
Mercury	0.5 ug/g in fish flesh	µg/g	NS	NS	
Molybdenum (total)	10	µg/L	2.56 (35.2 - 0.50) 169	3.88 (7.65 - 2.10) 8	0
Nickel (total)	**220	µg/L	3.02 (24.7 - 1.0) 169	5.42 (8.19 - 3.79) 8	0
Selenium (total)	5	µg/L	0.35 (1.81 - <0.1) 168	0.48 (0.62 - 0.38) 8	0
Zinc (total) [b]	30	µg/L	2.0 (12.9 - 0.3) 109	3.7 (12.9 - 2.2) 8	0
Miscellaneous					
Total Dissolved Solids	1,000	mg/L	875 (3821 - 149) 168	927 (1139 - 775) 8	25
Total Suspended Solids	the lesser of 10 mg/L or 10% over ambient	mg/L	12 (155 - <1) 169	51 (155 - 10) 8	75
pH (range)	8.5-6.5	standard units	8.4 (10.0 – 7.3) 179	8.6 (8.9 - 7.6) 8	62
Dissolved Oxygen (conc.)	>5.0	mg/L	8.6 (23.6 - 0.0) 177	8.3 (19.3 – 2.6) 8	13
Aesthetics		visual	NS	NS	
Oil and Grease		visual	NS	NS	

* Values below detection limits (<) are calculated at ½ detection limit, dataset is from 1995 - 2016 unless otherwise indicated
[b] historic data calculated from 2003 – 2016 due to analytical method changes
**based on hardness of 300 mg/L
NS: Not Sampled

ANNUAL WATER QUALITY OBJECTIVES SUMMARY
SOURIS RIVER - MANITOBA/NORTH DAKOTA BOUNDARY 2016
US05NF0001 WESTHOPE

WATER QUALITY PARAMETER	WATER QUALITY OBJECTIVE	UNITS	HISTORIC DATA** Median (max-min) # samples	ANNUAL DATA 2016 Median (max-min) # samples	%EXCEEDANCE (2016)
Organic Parameters					
Atrazine	2	µg/L	0.0134 (0.0464 - 0.0031) 72	0.0253 (0.0344 - 0.0104) 5	0
Bromoxynil	5	µg/L	0.0063 (0.2020 - 0.0011) 78	0.047 (0.0081 - 0.0012) 5	0
Carbaryl	90	µg/L	NS	NS	
a-Chlordane	0.0043	µg/L	<0.0001 (<0.0001 - <0.0001) 75	(Below Detection Limit) 5	0
g-Chlordane	0.0043	µg/L	<0.0001 (<0.0001 - <0.0001) 74	(Below Detection Limit) 5	0
DDT	0.001	µg/L	<0.0004 (0.0027 - <0.0004) 75	(Below Detection Limit) 5	0
Dieldrin	0.0019	µg/L	0.0003 (0.0003 - <0.0003) 75	(Below Detection Limit) 5	0
Dicamba	In development	µg/L	0.0088 (0.0451 - 0.0011) 78	0.0195 (0.0195 - < 0.0004) 5	0
Diclofop-methyl	In development	µg/L	<0.0074 (<0.0074-<0.0074) 76	(Below Detection Limit) 5	0
Heptachlor	0.0038	µg/L	<0.0000(<0.0010 -<0.0001) 70	NS	
MCPA	0.20	µg/L	0.0146 (0.3150 - 0.0008) 78	0.0021(0.0323 - 0.0008) 5	0
Parathion	0.04	µg/L	<0.0155 (<0.0155 - <0.0155) 20	NS	
Picloram	0.05	µg/L	0.0398 (0.1700 - 0.0067) 78	0.0663 (0.1700 - 0.0266) 5	38
Phenols (total)	1.0	µg/L	NS	NS	
Polychlorinated biphenyl (total)	0.001	µg/L	<0.0002 (<0.0002-<0.0002) 43	NS	
Triallate	0.57	µg/L	0.0400 (0.0600 - 0.0100) 76	(Below Detection Limit) 5	0
Trifluralin	0.10	µg/L	<0.0026 (<0.0026 - <0.0026) 76	(Below Detection Limit) 5	0
2,4-D	4.0	µg/L	0.0538 (0.5870 - 0.0028) 78	0.0513 (0.0531 - 0.0310) 5	0

** For Pesticides, values are for data above detection limits
**dataset is from 1995 - 2016 unless otherwise indicated
NS: Not Sampled

APPENDIX F

Water Quality Monitoring Plan for Sherwood and Westhope

1. Sherwood Monitoring Plan

Season	No. of Site Visits	No. of Samples Per Year			
		Dissolved Oxygen	Major Ions	Nutrients	Trace Elements
1 (Mar-Jun)	2	2	2	2	2
2 (Jul-Oct)	4	4	4	4	4
3 (Nov-Feb)	1	1	1	1	1
TOTAL	7	7	7	7	7

2. Westhope Monitoring Plan

Season	No. of Site Visits	No. of Samples Per Year				
		Dissolved Oxygen	Major Ions	Nutrients	Trace Elements	Pesticides
1 (Mar-Jun)	3	3	3	2	3	3
2 (Jul-Oct)	3	3	2	3	2	1
3 (Nov-Feb)	2	2	2	2	2	
TOTAL	8	8	7	7	7	4